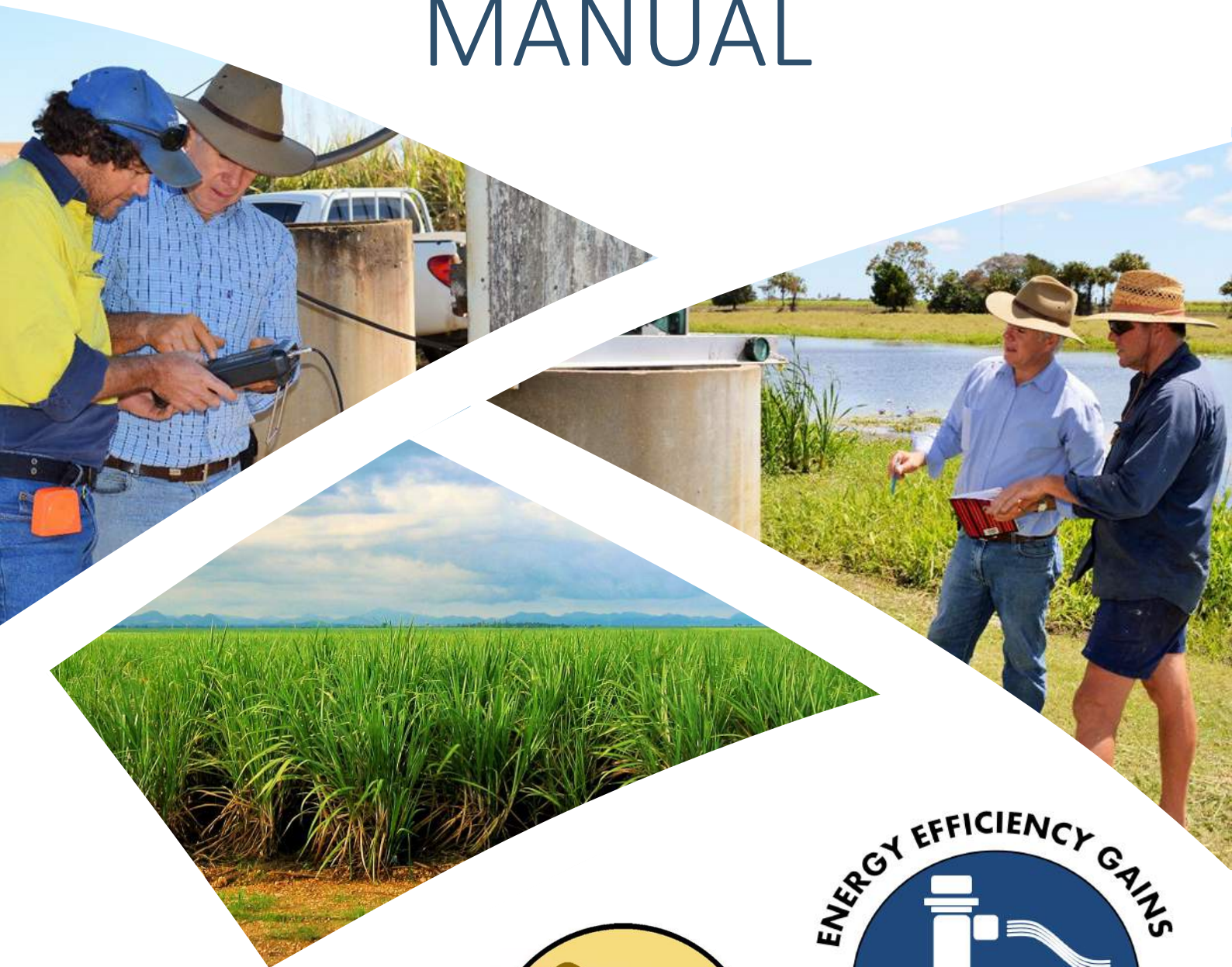




PROCEDURE OF ENGAGEMENT MANUAL



Australian Government
Department of
Industry and Science



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1. Introduction

The Energy Efficiency Gains for Australian Irrigators Project was funded by the Australian Government Department of Industry through the Energy Efficiency Information Grants program. The aim of the project was to raise Australian irrigators' awareness and capacity to adopt energy efficiency practices and technologies.

The project was conceptualised with the following prior knowledge:

- The agriculture sector is difficult to engage, and is generally slow to adopt new or innovative technologies or information. Farmers are also generally 'time poor' and are not inclined to read or believe information in wordy reports, particular web based material.
- Australian irrigators are large consumers of energy, used to pump and apply irrigation water to their crops. The cost of energy is increasing rapidly and this is likely to continue well into the future. This energy cost increase has placed many irrigation farmers under considerable economic pressure.
- While there is a plethora of information relating to energy efficiency, available from various sources, it usually covers a wide range of applications and is not specific enough to meet the farmer's individual needs.
- Irrigators are reluctant to accept that they are not already doing everything possible to increase the energy efficiency of their enterprise.
- The most effective and proven method of engaging rural land holders is one-on-one engagement, delivered by known and trusted industry representatives. Information delivered in this manner is generally tailored to a particular farmer, and is therefore readily accepted and adopted.
- BBIFMAC (Burdekin-Bowen Integrated Floodplain Management Advisory Committee) is a non-government, community-based natural resource management group that has a history of successful engagement with local sugar growers in the Burdekin region.

Using the Burdekin region of North Queensland, Australia's largest irrigated sugarcane growing area as the main focus of the project, the project is concerned with the energy consumption associated with pumping water for irrigation of sugarcane crops. The main findings of the project have also been shared with other irrigated sugarcane areas in south-eastern and central Queensland, as well as with the cotton industry in western Queensland and the horticulture industry in the Bowen-Gumlu area.

It has long been recognised that the agricultural sector is difficult to engage, due in part to farmers being time-poor, but also due to a high level of distrust of government organisations and government funded projects. BBIFMAC (Burdekin-Bowen Integrated Floodplain Management Advisory Committee) is a non-government, community-based natural resource management group that has a history of successful engagement with local sugar growers in the Burdekin region.

Through BBIFMAC the project has successfully engaged more than 120 individual cane growers, assessed the whole of farm irrigation energy efficiency of more than 235 individual sugar cane farms and conducted more than 30 detailed pump and irrigation efficiency assessments.

The purpose of this engagement manual is to outline the process by which BBIFMAC successfully engaged farmers in this project and the key learnings that may be transferred to other areas and organisations seeking to implement similar initiatives with irrigators in the future.

2. Background

2.1 Project Context

Funding

In 2012 community based natural resource management organisation Burdekin-Bowen Integrated Floodplain Management Advisory Committee (BBIFMAC) applied for funding for the project under the then Clean Energy for the Future funding stream through the Australian Government.

BBIFMAC was successful in receiving funding from this avenue for a two year project which commenced in June 2013. The intent of the project was to develop and demonstrate a process for effective delivery of quality information to Australian irrigators to overcome the low adoption of energy efficiency methodologies and technologies. This would be achieved by effectively delivering unbiased, factual and practical information on the range of energy efficiency gains that can be made in irrigation management and system design.

Due to BBIFMAC's location in Ayr, at the heart of Australia's largest irrigated sugar producing region, the Burdekin delta and Burdekin River Irrigation Area, the project has focussed on engaging sugarcane enterprises in the Burdekin. BBIFMAC has also successfully engaged with irrigators from other sugarcane growing regions and other crop irrigators elsewhere in Queensland to promote the project findings, including the horticulture industry in Bowen-Gumlu, the cotton industry in Emerald, and irrigated sugarcane enterprises in the Burnett, Isis and central Queensland regions of Maryborough, Childers, Bundaberg, Sarina, Mackay and Proserpine. These localities are referred to as satellite areas for this project.

Geographic area of interest

The Burdekin is the largest sugar-producing region in Australia with an annual production of around 8-9 million tonnes of sugarcane (more than a quarter of Australia's total cane production). Four local sugar mills all owned by Wilmar, produce 1.3 million tonnes of raw sugar from Burdekin sugarcane.



Above: A typical Burdekin sugarcane farm.

There are approximately 575 small to medium enterprises (SME's) that farm the 80,000ha of land in the Burdekin that is dedicated to sugarcane. There is also a thriving horticulture industry in the Burdekin and Bowen areas with more than 200 SME's producing vegetables and tropical fruit, nuts, cereals and grains.

The primary **objective** of the project was to empower Small and Medium irrigation Enterprises (SME's) to make **informed decisions** about improving on-farm irrigation **energy efficiency**.

Energy use for irrigation

The vast majority of sugarcane growers in the Burdekin area use electric pumps to pump water for irrigation. A smaller number of farms also use diesel pumps. For many farms, electricity and diesel consumption for irrigation pumping is now one of the highest input costs after harvesting. The amount varies considerably with the influence of soil type, furrow length, duration of irrigation, water source (surface vs underground) and irrigation delivery method (e.g. high pressure vs low pressure systems) but is likely to rise sharply for all irrigators as the cost of electricity and diesel increases into the future.



This high energy cost for irrigation is often the result of three significant factors which may each occur on farms to varying degrees:

1. Use of inefficient pumps (old and worn, in need of maintenance or over-sized for the application);
2. Inefficient irrigation management (inefficiencies in pipe/irrigation delivery systems or incorrect matching of water application to crop requirements e.g. overwatering); and
3. Inappropriate use of tariffs (inadequate understanding and use of available tariff rates).

Above: Conducting a pump efficiency test.

Contributing factors to these inefficiencies include the fact that the Burdekin area has been irrigated for more than 100 years and thus there is aging infrastructure (a reasonably large proportion of pumps are more than 20 years old, with some more than 50 years old), combined with historically a higher priority placed on 'ease of use' with regards to irrigation system design rather than system efficiency. In addition there has been a very low understanding of the importance of regular pump and bore maintenance to maintain flow efficiency.

SAVING MONEY IN IRRIGATION

- ✓ Improved **pump efficiency** can lead to an immediate reduction in the cost of pumping water for irrigation (dollars(\$) per mega-litre (ML) of water).
- ✓ **Friction losses** from incorrect pipe sizing and configurations can add substantially to the cost of pumping water to the crop (the pump works harder and flow rate is reduced)
- ✓ Improved **irrigation efficiency** can reduce the amount of water required to irrigate a crop (less water pumped=less energy consumed).
- ✓ Utilising the best **tariff** results in reduced costs (\$) per kiloWatt hour (kWh) of energy consumed.

Burdekin Bowen Integrated Floodplain Management Advisory Committee (BBIFMAC)

BBIFMAC is an independent, not for profit, community-based natural resource management organisation which has been assisting the farming community in the Burdekin-Bowen areas to remain viable by adopting best management practices for agronomic, economic and environmental sustainability for close to 20 years. Recognizing that farmers are time and resource poor, BBIFMAC has successfully delivered information and technology to the hard to reach rural sector through close engagement with individual growers and by collaborating with local industry bodies.

BBIFMAC has a reputation within the local community as a neutral, unbiased organisation that can be trusted to deliver objective, practical advice and services to cane growers, industry and community groups and external government and private clients.

The project used **trusted local organisations** and consultants to deliver high quality and **relevant information** to irrigators.

2.2 Project Outline

Aims and objectives

The primary aim of the project was to develop and demonstrate a systematic process for the effective delivery of quality information to Australian irrigators and build their capacity to implement energy efficiency measures on their enterprises. The project concept was developed in response to a recognition that there is low adoption of energy efficiency methodologies and technologies in the irrigation sector. The intent was that the process developed in this project would provide a mechanism to bridge the gap in growers' understanding of what information and tools are available and where to find them, by presenting information that is relevant and tailored to local irrigation and farming practices.

An abundance of energy efficiency information for Australian irrigators already exists, however for many irrigators knowing where to find the information in a format that is readily understandable and applicable to their situation, is a major impediment to their uptake of energy efficiency measures.

A whole of system approach was employed to identify where energy efficiency gains could be made through improved irrigation infrastructure design and improved irrigation application in the field. This included scrutinising pumping infrastructure to identify options and opportunities for energy efficiency gains, using appropriate tools and technologies to review water use and application efficiency, and exploring options for maximising utilisation of the best available irrigation tariffs through matching irrigation patterns with tariff rates.

Key components of the process included:

- Utilising existing, trusted local industry organisations and consultants with well established rapport with irrigators to deliver key project components and to promote the project through grower networks;
- Conducting high level whole-of-farm irrigation energy consumption benchmarking assessments with local sugarcane growers in the Burdekin area;
- Conducting detailed tariff reviews on a small number of SME's;
- Conducting detailed farm scale electric pump and irrigation efficiency assessments on a small number of local cane farms;
- Distribute key findings from the project through Case Study reports and videos;
- Training of local industry staff to conduct some aspects of pump and irrigation efficiency testing and to assist farmers to make informed decisions about irrigation system design and delivery; and

- Promoting the project findings and information delivery model by engaging other key irrigation industry bodies within other areas of Queensland.

Target audience

The project targeted:

- All Australian irrigators by demonstrating a model for engagement and delivery of energy efficiency information in a user friendly form;
- Up to 800 individual irrigation farm owners and managers in the Burdekin and Bowen irrigation areas of North Queensland (canegrowers, fruit & vegetable growers);
- Irrigators from each of three satellite areas (Burnett, Mackay and Emerald);
- The major sugarcane and horticulture industry agencies that provide support services to irrigators in North Queensland; and
- Key irrigation industry bodies throughout Australia.

Project partners

BBIFMAC partnered with a number of key specialist organisations to deliver the major components of this project:

AgriTech Solutions

AgriTech Solutions specialises in irrigation research and management in the sugarcane industry. AgriTech Solutions undertook the irrigation efficiency and tariff review assessments for the project, as well as contributing significantly to the whole-of-farm energy use benchmarking assessments and engagement with satellite areas.

National Centre for Engineering in Agriculture (NCEA)

The NCEA is one of Australia's leading organisations dealing with energy efficiency in agriculture. NCEA, a business entity within the University of Southern Queensland, have developed a number of computer based tools which assess all aspects of pump and irrigation related efficiency. The NCEA has provided significant input to the training of local industry staff and the development of the on-line whole of farm benchmarking tool and project website.

Project collaborators



A key influence on whether time poor irrigators will uptake the project findings and actually make energy efficiency improvements part of their core business is to ensure that the practices are endorsed by local industry bodies and farmers. In addition, using the extensive networks of industry bodies ensured that the projects' benefits and findings reached a wider range and number of cane growers. To this end BBIFMAC collaborated with local and satellite area industry groups and organisations.

Above: Project partners and collaborators in the field.

A key **desired outcome** for the project was to raise the **capacity** of irrigators to **adopt** energy efficiency measures.

These included:

- Lower Burdekin Water (LBW)
- Burdekin Productivity Services (BPS)
- Canegrowers Burdekin Limited (CBL)
- Pioneer Canegrowers
- Kalamia Canegrowers
- Invicta Canegrowers
- Growcom
- Bowen Gumlu Growers Association (BGGA)
- Burdekin Delta Fruit and Vegetable Growers
- Sugar Research Australia (SRA)
- Isis Productivity Board
- Bundaberg Sugar Services
- Mackay Area Productivity Services (MAPS)
- Queensland Department of Agriculture, Fisheries and Forestry (DAFF, Emerald)
- Wilmar
- Ergon Energy
- Farmacist
- Burdekin Grower Services (BPS)

Project consultants and contractors

A number of private consultants and contractors were also engaged to deliver specialist services to the project, particularly in the areas of training, information provision and pump and irrigation efficiency assessments:

- Daley's Water Services
- Merv Jessen Irrigation Services Contractor

Other contributing organisations

A number of other local organisations and service providers also contributed advice, information and/or services to the project:

- Ayr Boring Company
- Horan and Bird Solar
- Hydrotech Monitoring
- Grundfos Pumps
- Burnett Inland Economic Development Organisation/Aqua Gold Consulting

Project management

BBIFMAC Committee of Management

The responsibility for the higher level financial and project management for the EEGAI project was undertaken by the BBIFMAC committee of management (BBIFMAC chairman, secretary, treasurer and five committee members). The committee meets every two months to review the performance of BBIFMAC and its current projects. Progress and financial reports on each of the projects are presented and reviewed at these meetings.

Key responsibilities of this committee with regards to this project include:

- Oversee the project finances to ensure adherence to the contractual obligations of the funding body;
- Ensure the project fulfills its commitments to stakeholders; and
- Communicate important issues or outcomes to the BBIFMAC membership.

EEGAI Technical Steering Committee

At the onset of the project, a Technical Steering Committee was formed to guide the implementation of project activities and the engagement process. The technical steering committee had representation from all of the project partners and major collaborators listed earlier.

A terms of reference was developed for the Technical Steering Committee which included the following roles of the committee:

- Ensure the delivery of the project is aligned with the overall project plan;
- Ensure the project makes good use of the available resources;
- Assist with understanding and addressing industry and grower needs;
- Guide and assist the communication with, and engagement of growers and key stakeholders;
- Authorise changes to the project with a view to maximising the effectiveness of project delivery;
- Provide input regarding grower and industry needs in relation to energy efficiency information;
- Advise on improvements and innovations to project implementation and delivery;
- Provide technical advice and guidance to project staff as required; and
- Review and approve project deliverables and outputs.

3. Key Engagement Activities

3.1 Philosophy of Engagement

The main aim for engagement in the project was to deliver industry endorsed, simple to understand, tailored information to irrigators using a variety of tools and delivery methods.



The agricultural sector is notoriously difficult to engage and it is often the case that "grass roots" land managers are more likely to adopt or accept information that is delivered in a one-on-one situation by a trusted local or by seeing a new technology being effective on their or a similar or neighbouring property (seeing is believing).

Above: A project consultant advises a grower on his farm.

The project also aimed to tackle the main issues preventing farmers from taking action including:

- A lack of time to investigate
- Too much irrelevant information
- A lack of resources to do their investigation
- A lack of trust or understanding of the material available
- A lack of skills or confidence to assess their particular situation

- A lack of ability to translate energy efficiency gains in dollar values and pay-back periods.

The project applied a method of delivery designed to address these common constraints by using local specialists and organisations that:

- Have proven trust and rapport with farmers and the industry generally.
- Have the appropriate resources, knowledge, tools, and equipment.
- Are able to collect, filter and collate the relevant information.
- Have the skills to modify or translate the information into a language understood by the target audience(s).
- Will provide options and recommendations for the irrigator to consider.

By raising awareness of the key energy efficiency issues through a range of mediums (newsletters, field days, seminars, training, fact sheets, case study reports and individual energy audits etc) and clearly demonstrating potential cost savings, SMEs are more likely to change their attitudes and adopt the cost saving and improved energy efficiency technologies developed.

To achieve this BBIFMAC undertook a range of activities including information provision, field activities, training, promotion and community involvement through the use of proven engagement methods:

- One-on-one, on-farm engagement.
- Small group workshops and training sessions.
- Public information sessions.
- Distribution of Fact Sheets.
- Computer/internet based tools.
- Field days and on-farm demonstrations.

3.2 Information Provision

Information provision was a significant component of the project, with considerable time and effort spent in the initial stages of the project sourcing and filtering the currently available information on energy efficiency measures and technologies available for large volume irrigation. The available information was then filtered and customised to the local situation for the Burdekin sugarcane area and delivered to local growers via a range of means, including a large public forum at the onset of the project, circulation of fact sheets, development of a project website and distribution of information packs and training materials.

Energy Efficiency Expo

An energy efficiency expo was held in the early stages of the project. It was held in Ayr, in the heart of the Burdekin sugarcane production area in February 2014.

The primary aims of the expo were to:

- Highlight the main aspects of the project;
- Present local growers and industry representatives with an overview of the range of irrigation energy efficiency measures currently available; and
- Provide a forum to make initial contact with local growers and encourage their participation in the project.

Enabling sufficient time after presentations for **informal discussions** between audience and presenters was a fundamental to enhancing **information exchange** at events.

The expo provided attendees with access to industry experts, information displays and industry booths. There were 10 guest speakers who covered a range of topics including:

- Pump efficiency and auditing.
- Irrigation efficiency design and scheduling.
- Bore maintenance and design.
- Automation and irrigation management software programs.
- The pricing structure of new and existing irrigation electricity tariffs.



The event was a huge success with 141 people attending and more than 50 growers signing up to participate in the project. The timing, venue, good publicity (radio, newspaper articles, paid advertisements), brochures placed at major agribusiness outlets, including all the local banks and collaborating with grower and industry organisations to promote this event through their extensive networks all contributed to the high attendance.

Above. Attendees at the Burdekin Energy Expo.

The timing of the forum was also particularly advantageous as growers had just received their power bills after a hot, dry summer of intense irrigation effort and thus irrigation energy efficiency was of particular interest to them. Offering a free BBQ lunch and refreshments was also used to entice attendance and was well received.

Holding the forum at the onset of the project proved to be an extremely successful way of raising interest and the profile of the project within the local community in a short space of time, and particularly the target audience, of whom a large number then signed up immediately for participation in the proposed project activities.

Whilst the presentations were kept relatively short, by including lunch immediately afterward participants had ample time to mingle with presenters and discuss issues of personal interest to them in detail. This opportunity for one-on-one interaction with presenters was extremely well received by participants as it facilitated further exchange of information between presenters and growers. Many growers were more comfortable raising

TIPS FOR A SUCCESSFUL EVENT

- ✓ Use a range of promotional sources (e.g. print, radio, industry networks).
- ✓ Choose a time of year when issues are topical and growers are less busy.
- ✓ Cover a variety of subjects that are relevant to local issues.
- ✓ Keep presentations short and allow plenty of question and answer time.
- ✓ Include time for informal, one-on-one discussions after the event.
- ✓ Provide good quality food and refreshments.
- ✓ Capitalise on participants' enthusiasm at the event to encourage them to sign up for other project activities.

their questions with presenters in a more informal, one-on-one setting rather than in front of the whole audience.

In a post expo survey of participants there was overwhelming support for the project and satisfaction with the expo's format and content.

Delivering **industry endorsed**, simple to understand and locally **tailored** information to irrigators was the key to **maximising the uptake** of new information.

Fact Sheets

As part of the tools developed for dissemination of information to irrigators, a number of Fact Sheets were developed. A total of four (4) Fact Sheets have been released for the project. These two page documents present easy to understand information on topics of key interest to irrigators of local relevance and importance. These were used as support materials for participating irrigators, as well as being made available to the wider irrigation industry through industry networks, websites and grower information sessions.

The four fact sheets developed were:

1. Energy Efficiency Gains for Australian Irrigators - project overview:
This fact sheet summarised the project aims and desired outputs.
2. Electricity Bills and Meter Readings:
This fact sheet provided important information on how to monitor and read the three common types of electricity meters.
3. Irrigation Tariff Options and Information:
Important information on the available rural/irrigation tariffs and how best to utilise them was the subject of this fact sheet.
4. Improving Irrigation Efficiency:
This fact sheet highlighted the potential energy savings that can be achieved by increasing surface irrigation efficiency by reducing irrigation time and volume.

A number of other topics were identified over the life of the project with the potential to be developed into Fact Sheets, however time constraints prevented the development of these before the conclusion of the project. Other means of conveying the information were utilised however, including making these topics the focus of presentations at training, workshops and information sessions.

Project Webpage

A stand-alone project web page was developed to make available information such as the Fact Sheets, Expo presentations and other project materials as they were developed. For example a Tariff Calculator was developed as a tool for growers to quickly and easily compare the different rural tariffs available to them, based on inputting their current usage. This was developed using Microsoft Excel and was provided on the website for easy access.

Other project resources such as the Fact Sheets and presentations from information sessions were also provided on the website as PDF documents suitable for download. Short You-Tube videos of major project events were also included on the webpage for download. News stories about the project and a Contact us' section, including a map of the office location and a web comment form were additional features.

The whole of farm on-line benchmarking tool was also a key feature of the webpage. Data and output graphs from the more than 235 participating farms is contained within the website and is accessible by password only through the website.

The website was developed, hosted and maintained by NCEA with BBIFMAC EEGAI Project Manager and steering committee guidance and input. Links to the website were placed on the BBIFMAC webpage and promoted in all major project communications, including the media and through local industry network communications. The functions and resources available on the website are demonstrated in presentations about the project at meetings, workshops, seminars and training sessions.

The most popular pages were the home page, followed by the benchmarking page, tariff calculator and the Fact Sheets.



Figure 1. Screen capture of the EEGAI webpage.

Case Study Reports

Over the course of the project, through the on-farm pump and irrigation efficiency assessments that have been conducted with individual farmers, a number of key learnings and common issues have been identified. The key findings from six of these were developed into Case Studies. The purpose of this was to demonstrate, using real situations from the local area, the impact of changed practices and new technologies on farm energy efficiency.

The Case Study topics were:

1. *Implications of iron oxide residue build up on bore and pipes:* this farmer reduced the pumping cost of one pump by almost 40% by cleaning out the iron oxide build-up in the bore and pipes after the project identified the problem.

2. *Implications of using a butterfly valve to restrict water flow:* this farmer found that operating his pump with a partially closed butterfly valve to regulate water flow was costing him almost double (in energy cost per megalitre) compared to when it was operated fully open.
3. *Choosing the most effective electricity tariff:* this farmer identified \$5,600 savings per year just by changing tariffs.
4. *Implications of a collapsed pipe on pump efficiency:* this farmer will halve his pumping costs after a pump efficiency assessment identified a problem with a collapsed underground pipe that was causing his pump to consume double the amount of electricity to pump the water he needed.
5. *Improvements to irrigation efficiency and how to achieve it:* this farmer identified that their energy cost could be halved if they better matched the volume of water applied with the crop's demand
6. *Understanding your pump's duty cycles:* this case study compared the cost of running two different types of irrigators from the same pump.

Developing **case studies** based on the experiences of **local farmers** enabled other farmers to relate to the situation and added **credibility** to the findings.

Before and after data from these sites was collected and the results summarised into a two page Case Study report for each topic, describing the particular farm situation and highlighting the issues identified and solutions implemented. Cost implications and the participating farmer's comments were included to make the reports more relevant and applicable to other farmers.

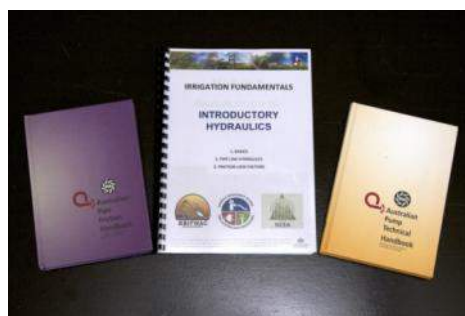
Case studies are a powerful way of conveying information to farmers because the situation and issues are often similar to those encountered on their own properties and presenting real data adds more credibility to the findings. Farmers identify more with examples from their own local area and are more familiar with the technical aspects of the farm activities and configurations from similar enterprises. The participating farmers' identities and property addresses were omitted to protect their privacy but relevant information such as crop and irrigation type, farm locality and size were included.

Training materials

Training packs and other resources were provided to field officers and industry staff who participated in the four Industry Skills Development Training Sessions that were conducted as part of the project.

A training booklet "Irrigation Fundamentals - introductory hydraulics" was developed by BBIFMAC and NCEA during the training period to summarise the course material and provide a take-home resource to assist students with their on-going learning. Two additional resources were also purchased from Pump Industry Australia Inc for students to keep as reference materials and to assist with field and classroom calculations. These were:

- Australian Pipe Friction Handbook (4th Edition)
- Australian Pump Technical Handbook (5th Edition)



Information packs

Information packs, containing the project fact sheets and a user guide for accessing and understanding the online benchmarking assessment tool were provided to participating SME's who attended small group workshops to review their irrigation energy assessment results. The information pack also included a USB stick containing electronic copies of these documents, as well as links to the project website, tariff calculator and the participants' individual log-in details (password and username) for accessing their results on the on-line tool.

Information packs containing a Project Overview document, Fact Sheets and copies of presentation material were also provided to attendees at seminars, workshops, field days and information sessions held both in the study area and also at events held in the satellite areas.



Above. Participants from the first small group workshop with their information packs.

Irrigation Australia Conference (Gold Coast 2-4 June 2014)

The project was presented at the Irrigation Australia Ltd (IAL) International Conference, held at the Gold Coast Convention and Exhibition Centre from the 2nd to the 6th June 2014. On Thursday 5th June 2014, Michael Scobie (National Centre for Engineering in Agriculture) and Patrick Daley (Daley's Water Services) presented on 'Irrigation Experiences in the Burdekin' on behalf of the project. The presentation covered the Energy Efficiency Gains for Australian Irrigators program to date. There were 1,581 visitors to the conference, from 14 different countries.

The presentation enabled the project concepts and early learnings to be communicated to a broad audience of industry staff and growers. It also provided a good forum for the exchange of ideas between project staff and industry experts from around the world.

3.3 Field Activities and Training

Farm Scale Energy Assessments

The purpose of the whole of farm energy assessments was to provide irrigators with a tool to benchmark the irrigation energy use and costs on their farm across several years and compare themselves to other irrigators in their district. As an end product growers obtained farm level information regarding their energy use and efficiency. The intent was once the irrigator was aware of their farm/s energy efficiency status, a closer look could be had at where efficiency gains can be made.

This component of the project was originally intended to be conducted as an "on-farm" energy assessment whereby a trained project staff member would visit a farm and conduct an assessment on-site and provide the results to the owner/manager at the time of the visit. It quickly became evident however that this approach was not practical due to the large number of pumps used for irrigation by many of the enterprises and consequently the amount of data required and time taken to input it into the online tool.

Instead data collection was achieved through the use of simplified take home forms that growers could complete in their own time and which gathered the necessary information on their farm characteristics and pump details (electric and diesel). Electricity consumption and farm production data was obtained directly from the energy supplier (Ergon Energy) and sugar mill company (Wilmar) by the project team on behalf of the grower through the use of consent forms signed by the grower.

This streamlined the data collection process however there were some delays obtaining the necessary information from the energy provider as all requests for data were directed through a general customer service centre. Delays in the receipt of completed forms were also experienced as much of the data collection period coincided with the busy sugar cane crushing season and during this period many growers found it difficult to find the time to complete the forms.

Once the necessary data was obtained a project staff member entered it into the online benchmarking tool developed by NCEA for the project and housed on the project website. Over the life of the project 522 whole of farm energy assessments were conducted on 235 individual sugar cane farms (SME's) in the Burdekin region.

Where sufficient data was able to be obtained, three separate assessments were conducted for each farm (one each for the 2012, 2013 and 2014 financial years). This enabled the grower to view the changes to their electricity use over time and view the impact of seasonal weather variations on their energy consumption. This was possible for electricity consumption only as information on diesel consumption was insufficient for a comparative assessment for diesel powered irrigation pumps.

The results of these assessments and the underlying data was accessed via a password protected login to the online assessment tool developed by NCEA and hosted on the project website. Participating growers were able to view their individual farm results compared to the amalgamated data set containing the results from all the participating farms, presented as box and whisker plots.

In order to enable a more tailored comparison, growers were also able to use filters to compare themselves to a smaller data-set of just those farms in their water supply area or mill area. If a grower owned or managed multiple farms, each farm was assessed separately according to its individual farm identification number. This was necessary as many farms are in different localities, often with vastly different soil, water supply, water use and

Visual representation of results using graphs allowed growers to **rapidly analyse** the outcome of their energy use assessments.

productivity characteristics and as such farmers tend to treat the farms as independent business units.

Growers were also able to view graphs of their electricity cost and consumption (including peak and off-peak usage where applicable) for each account by billing quarter. This provided the grower with a visual representation of each pump/account's usage history which could be viewed separately or combined with all the other pumps/accounts across a whole farm.

For many growers this was the first time they were able to easily see how each pump/account compared to others on their enterprise and thereby rapidly identify any anomalies in charges or consumption. It also enabled growers to identify whether they were utilising the peak and off-peak tariffs correctly. For example for an account on a tariff with peak and off-peak (high and low rate) usage capability, a grower could readily see if peak power was being used more often than off-peak. If this was occurring more than occasionally, and cannot be prevented through changes to management or infrastructure, then it would be advisable to investigate changing to a different tariff (e.g. one that is more suitable for round the clock or peak time usage).

Please refer to Section 3.3 for examples of the output graphs generated for 'whole of farm' energy use benchmarking participants.

A number of interesting results and trends were evident from the data. A marked increase in the electricity cost and consumption was noticeable for most enterprises when comparing whole of farm irrigation energy use from 2012 through to 2014. This is due in part to a rise in electricity prices over this time, but also an increase in irrigation energy consumption as this coincided with drier years in 2013 and 2014 when most farmers were forced to run their pumps more often to keep up with the water demand of their crops.



Above: Project staff and consultants assess a pump.

Other trends have also become evident: in most cases it is clear that pumping from an underground source costs more in electricity consumption than pumping from a surface water source (the pump must work harder to deliver the same quantity of water from a greater depth). Clear differences in the effect of soil type on water infiltration and thus amount of time required to water a field using furrow irrigation were also apparent in the results.

It is also clear from this component of the project that growers seldom have time to review energy use across their enterprise, particularly on an annual basis. Growers also have no accurate way of benchmarking their enterprise against others in the area in terms of energy efficiency.

This project has successfully filled this gap for participating growers who are now fully aware of the need to regularly monitor and benchmark their energy use, and how significant the savings can be if they implement the available energy efficiency measures.

The irrigators also developed confidence that the benchmarking was worthwhile and meaningful because the:

- Information had been collected, collated, error checked and entered into the database by an independent and trustworthy organisation (BBIFMAC);

- Data set is of a large enough size that the cost spread is a realistic representation of what happens across the district;
- Information can be filtered to display information that they believe is more relevant to them; and
- Once explained, the figures are easy to read, interpret and modify.

Recognising that **growers are time poor** workshop durations were kept deliberately short to **reduce disruption** to farmer's schedules.

Small Group Workshops

Because of the initial complexity of the whole of farm energy use benchmarking graphs and the potential for misinterpretation of results, it was deemed imperative that participating growers received some form of one-on-one guidance in reviewing their results for the first time. After receiving this 'training' growers were able to take home their individual log-in details and log into the online tool at any time and view their results or change their data.

Small group workshops were deemed to be the most time-effective means of conveying the results to participating growers rather than one-on-one farm visits. The workshops also enabled other aspects of the project, such as the tariff calculator to be introduced to participants. This proved to be the most effective way of communicating the project results and available resources to time-poor growers. A total of 15 workshops were held over a six month period. For those growers who could not attend any of the workshops, private one-on-one sessions were offered in the BBIFMAC office.

Because growers are busy with on-farm work for most of the year and are often reluctant to attend workshops, the sessions were kept short (two hours duration) and several time slots and days of the week were offered to ensure all needs were catered for.

As growers were provided with individual laptops to review their results privately during the workshop, numbers were kept low (maximum of six people per workshop/one person per laptop) to enable the two attending project staff members sufficient time to assist each grower access and interpret their results.

The format of the workshops involved project staff presenting the online tool using the actual amalgamated data set but with a demonstration farm to illustrate real farm data to the whole group on a screen and projector. After demonstrating how to access and interpret the graphs, growers were assisted to log onto the online tool using the laptops to view their own results. Once all growers had accessed and understood their results, project staff commenced a demonstration of the tariff calculator to illustrate the impact of the different tariffs on power bills. Following this session growers were then shown how to access the tariff calculator and using data from their own power bills, with assistance from project staff, ran scenarios to determine whether they were on the most cost effective tariff for their irrigation use.

Having two presenters and limiting the size of the group to a maximum of six people, enabled all participants to contribute and be engaged during the whole group discussions, ask specific questions (one-on-one) regarding their particular data, and to work independently with the whole-of-farm data set or the tariff calculator.

Other project resources and tools were also demonstrated in the workshop and growers were given a take-home pack, including the Fact Sheets produced by the project to date.

Feedback received during and at the conclusion of the workshops was extremely positive with all participating growers indicating an increase in their level of knowledge as a result of the workshop:

"Congratulations on a very successful workshop. I usually come out of meetings feeling I have wasted most of the time spent there, however with this workshop I found it thoroughly enjoyable and informative – I learnt a lot, the most that I have from any similar meeting."



"I haven't been to a meeting in 25 years - to be honest I was a bit sceptical about coming to this one but I'm really glad I did."

Left: Participating growers receive guidance from project staff in reviewing their farm level energy assessment results at small group workshops.

Industry workshops and seminars

Over the life of the project a number of workshops and seminars were delivered to SME's, agribusiness and industry bodies. The purpose of these workshops was to deliver energy efficiency information specific to irrigation SME's, including practical examples of how to measure the efficiency of different systems and to report on the findings of the project, including the case studies and benchmarking activities.

Half of these workshops and seminars were held early in 2014 and were aimed at presenting information on the project objectives and deliverables, and encouraging SME, agribusiness and industry involvement in the energy assessments and training aspects of the project. The remaining activities were held between March 2014 and December 2014 and focussed on reporting the outcomes of the project to date, recruiting new SME's to the project and promoting the project findings through local industry networks.

The duration of the workshops and seminars were deliberately kept short (1.5 hours presentation plus 30 minutes informal discussions over morning tea or lunch) due to the time of year they were held (prior to Christmas). The format involved a presentation introducing the project background and aims, the outputs from the whole of farm benchmarking tool (using the demonstration farm to show the graph outputs on the on-line tool), examples of key findings from the pump and irrigation efficiency assessments, outputs from recent tariff comparisons and a demonstration of the tariff calculator.

Invitees to the workshops included:

- Agribusiness managers from local banks, lenders and accountancy firms.
- Local industry organisations and peak bodies.
- Local and State government representatives.

Key findings from the more recent workshops and seminars included:

- Many agribusiness organisations and industry organisations do not fully comprehend the magnitude of irrigation electricity costs on the average Burdekin sugarcane SME;
- Many agribusiness and industry organisations are not aware of the range of energy efficiency initiatives and actions available to growers and the degree of savings that can be made through tariff changes, informed pump selection, sizing and maintenance, and the range of irrigation efficiency measures identified through the project; and

- Agribusiness and industry networks are a useful means of distributing project invitations and information to a wide range of SME's who may not yet have been engaged by the project.

Industry networks were a useful means of **distributing** project invitations and **information** to a wide range of SME's.

Pump and irrigation efficiency assessments

The Energy Efficiency Gains for Australian Irrigators project conducted more than 30 separate pump efficiency assessments on electric irrigation pumps in the Burdekin area. An Irrigation Services Contractor undertook the assessments for the project and visited 30 farmers in the Burdekin district to test the efficiency of one pump per farm. Using an ultrasonic flow meter, and pressure and suction gauges, a pumps' performance parameters were measured. Performance measures included the cost in dollars per megalitre of water pumped, as well as motor and pump efficiency, and inlet and delivery pressure. This is important information for farmers wishing to optimise their irrigation energy efficiency and each farmer was provided with a full report on their pump's cost and performance as well as recommendations for system improvements.

Irrigation efficiency assessments were also offered to those growers who participated in this component of the project. The irrigation efficiency assessments analyse the irrigation of the field that is serviced by the pump for which an efficiency assessment was undertaken. Using inflow rates, irrigation time and area serviced, the volume of water being applied to the field is compared to the amount of water the crop requires. In many cases a greater amount of water is being applied than is necessary for optimum crop growth, with the excess water being lost to deep drainage or run-off.

With furrow irrigation (which is the chief form of irrigation in the Burdekin) efficiency can often be improved by increasing the inflow rate which in turn decreases the duration of irrigation and the volume of water applied, which therefore reduces the cost of each irrigation event (less time spent running a pump/s). In some cases reducing row length can have a similar impact. There may however be management and cost implications associated with any such changes to infrastructure and irrigation practices. These are calculated along with the potential savings to irrigation pumping costs and reported to the farmer in an



irrigation efficiency assessment report, along with recommendations and advice on how to increase irrigation efficiency tailored to their specific farm's characteristics.

Each pump and irrigation assessment conducted to date has yielded highly useful results, both for the project overall and the individual participating farmer. Some of the higher magnitude energy savings that have been identified through this component of the project have been developed into case studies.

Above: Measuring irrigation flow rates.

Some of the key findings to date from this component of the project include:

- Information on irrigation energy efficiency that is relevant to the type of pumps used and irrigation systems in the Burdekin region is difficult for many growers to find;
- There is conflicting information being provided by the energy provider;
- Most growers have a very low understanding of how to best utilise the available electricity tariffs;

- There is a lot of misinformation circulating around the Burdekin region about pump efficiency and energy use, and the tools available for increasing pump efficiency;
- A large proportion of growers are applying more water than their crop needs; and
- Many growers believe that reducing a pump's speed or output will reduce the energy costs without fully understanding the implications of this in cost per megalitre of water pumped.

Tariff comparisons

In conjunction with the pump and irrigation efficiency assessments, detailed whole of farm tariff comparisons were offered to those same SME's. This involved collecting information on the energy consumption, tariffs and motor size of each of the irrigation pumps across the farm for a 12 month period. A detailed comparison of all the available irrigation tariffs is conducted based on this information and the potential savings (if any) of changing tariffs or changing irrigation scheduling to better fit in with tariff rates are calculated.

In many cases irrigators are not using the most cost effective tariff available to them or are not using the tariffs in the most cost effective manner. This can be due to changes in pump size and use over time, or changes to irrigation scheduling which no longer coincide with the times a tariff's low rate is available. Many irrigators also do not fully comprehend the cost implications of the different tariff rates and rely on the energy providers or electricians advice as to the most appropriate tariff. The cost savings by addressing these issues can be substantial.

It is important that any such analyses are based on at least 12 months of electricity consumption data as pump use for irrigation varies throughout the year as crop demand changes throughout its growth cycle and due to seasonal rainfall variations. It is often the case that the same tariff is not always the cheapest across all four quarters to the variations in energy demand/consumption over the year.

Each tariff review involved two meetings between the farmer and the consultant. The first was used to collect all required information, while the second meeting discussed the findings of the review and the actions the irrigator could undertake to implement any recommendations.

Industry skills development and training



The aim of the training sessions was to up-skill local businesses and individuals in the fundamentals of pump and irrigation efficiency testing, to provide on-going support to local growers and to benefit the local industry beyond the life of the project.

Above: Pump efficiency training for local industry staff.

Prior to this project there were no personnel available locally with the necessary skills or training to undertake or advise on on-farm pump efficiency evaluations.

The training program was delivered through four major sessions held in Ayr in March, May, October and November 2014. The training was conducted by consultants from Daley's Water Services Pty Ltd, University of Southern Queensland's National Centre for Engineering in Agriculture, and Merv Jessen Irrigation Services Contractor.

Up-skilling local individuals and industry staff to deliver key components of the project into the future is a means of ensuring the project leaves a long lasting legacy.

Each training session ran for two or three full days. Longer training sessions were not practical for the participants who had indicated that work commitments limited their availability. A minimum period of two days was necessary to collect field information and spend adequate time analysing and discussing the results. The training was broken up into four sessions over an eight month period to maximise learning opportunities. This format provided an opportunity for participants to review learnings and practice techniques away from the formal sessions. Trying to complete this training program in a single event would not have produced the consolidated learning that has occurred and increased the likelihood that the new skills will continue to be used in the district.

Each session has been delivered through a combination of field work (training participants in the collection of information in a range of real on-farm scenarios) and classroom sessions to analyse and review the collected information as well as discuss the theory behind the calculations. A number of pump and irrigation efficiency assessments were conducted in the field to give students hands-on experience with data collection methods in the field. Every pump and every irrigation situation is different and therefore students were exposed to a range of different on-farm and theoretical scenarios.

Topics covered included:

- Pump efficiency evaluations.
- Reading and understanding pump curves and pipe friction tables.
- Reading power supply meters.
- Measuring water flows.
- Identifying possible solutions to improve energy efficiencies.
- Entering field data into the centralised data analysis and management tool (IPERT: Irrigation Pump Evaluation and Reporting Tool) developed by NCEA.

At the conclusion of the training sessions students were provided with an opportunity to have their competency recognised by Irrigation Australia Limited and to use the skills obtained to work towards obtaining national accreditation.

It was evident that while the industry participants received training in the practical and theoretical aspects of conducting pump and irrigation efficiency assessments, it would take many more hours of practical experience before they would be able to offer the level of service and confidence provided by the project consultants. The trainees however have gained sufficient knowledge and ability to conduct the field measurements required and to advise growers on key areas where energy efficiency gains can be made and the energy efficiency services and technologies available to them. Breaking the training into several, smaller sessions has been beneficial to:

- Maximise participation of trainees.
- Minimise disruption at the trainee's workplace.
- Consolidate learning by revisiting topics on several occasions, over a long period of time.

- Develop relationships between the trainers and trainees, that may evolve into ongoing relationships after the project has ended.

Satellite area field days and study tours

One of the project's aims was to share key learnings with other irrigation areas. To this end information sessions and field demonstrations were held in the sugarcane production areas of Central and South-East Queensland (Mackay/Proserpine/Sarina and Bundaberg/Childers/Maryborough).

More than 70 sugarcane growers from these areas attended these events to learn about pump and irrigation efficiency measures and to discover more about the project results. On farm irrigation and pump efficiency assessment demonstrations were conducted on local properties and information sessions with a range of guest speakers were held to cover topics of interest to irrigators from these areas.

A field day was also held in the cotton growing area around Emerald in Central Western Queensland to showcase how the findings from this project are also applicable to other irrigation industries across Australia.

The sessions were been extremely well received in the satellite areas with enormous interest in the project generated and a strong desire from both industry staff and local participating growers to see the project's services offered in their area. Project staff worked



closely with industry organisations in these satellite areas with regards to the organisation and promotion of these events. The industry bodies who collaborated in this component of the project included Bundaberg Sugar Services Ltd, Isis Productivity Ltd, Bundaberg Canegrowers, Mackay Area Productivity Services, Sugar Research Australia, Mackay Sugar, Cotton Australia and Department of Agriculture, Forestry and Fisheries, Emerald.

Above: Participants at a field day held in Emerald.

Feedback received from one of the participating industry bodies following one of these events is provided below:

"On behalf of Isis Productivity Ltd. and its members, I would like to take the opportunity of expressing our thanks for allowing our organisation to be part of the EEGAI / BBIFMAC energy project. We would like to congratulate all of the presenters on the way that they delivered and received the agenda discussions and questions over the recent two day event held in the Isis-Bundaberg region.

Involvement in this project has created much interest in energy reduction potentials through varying avenues in the Isis irrigation region. Isis Productivity Ltd now have an improved capacity to be able to develop a strategy to progress these initiatives. Again please accept our thanks for your time and effort in making this event a success. IPL look forward to further engagement and professional interaction with all of those involved".

3.4 Tools and Resources

In addition to information provision and field activities, a number of project specific tools were developed. These were developed by project staff and consultants and tailored to the project focus area and designed to assist growers in assessing and managing irrigation energy efficiency.

Project resources made available via the project **webpage** enabled a wider audience to access the project's services.

These included the development of an interactive tariff calculator, the on-line benchmarking assessment tool and a series of project videos.

Tariff calculator

A tariff calculator was developed using Microsoft Excel and made available through the project website. It has been tailored to irrigation energy users in the Burdekin region (utilising Ergon Energy electricity tariffs current at 1 July 2014) but may also be applicable to other irrigators in Queensland depending on their energy provider.

Above: Screen capture of the tariff calculator developed for the EEGAI project.

A tariff comparison calculator can help irrigators assess their energy consumption and suggest the most cost effective tariff for that consumption. In this tariff calculator irrigators add information on their irrigation electricity consumption, billing period, and pump motor size in the yellow cells (from a recent power bill), and the calculator will list the cost per day for that usage and suggest the cheapest tariff based on the information inputted (green cell); it automatically accounts for the relevant service and access fees.

The calculator is based on the current tariff pricing structure and includes both transitional tariffs (which will be phased out by 2020) as well as the newly available tariffs which are designed to replace them.

The calculator is designed to be used as a reference tool only, and growers are encouraged to enter a full 12 months of energy consumption data and to seek professional advice for irrigation and pumping energy consumption specifics before making any changes to their tariffs.

The use of the tariff calculator is demonstrated at project events and used to illustrate the impact that irrigation scheduling, pump sizes and energy consumption can have on tariff charges. It is also easily accessible via the project website.

Online benchmarking tool

An online benchmarking tool was developed to collect, analyse and present irrigation energy consumption for farms participating in the whole-of-farm energy use benchmarking component of the project. It was developed as an online tool by NCEA and housed on the project webpage. To protect individual participants' privacy this resource was password protected and therefore was only accessible by participating growers and project staff.

The data that was collected from each of the participating growers on their farm details (size, location, irrigation type, water source, mill area and number of diesel and electric pumps used for irrigation purposes), energy consumption of the irrigation pumps and production statistics for the farm (hectares harvested, tonnes harvested and sugar content of the crop) was entered into the online database by project staff. This was done using an administration login and creating a new record on the database, and once data entry was complete the data set was saved with a unique user name and password. Only project staff, the NCEA webmaster and the participating grower are able to view an individual's farm results.

The online tool is comprised of 10 pages, with page 10 presenting the results of the whole of farm benchmarking assessment and the preceding 9 pages containing the data on which the assessment was based. Once a grower is supplied with their individual farm's login details, and training on the interpretation and use of the online tool, they are able to view their farm results from home and amend or add to the data entered for their farm on the online tool at any time.

Several months of effort was involved in developing the tool, trialing it with real data and then tailoring it to the project's needs as the whole of farm benchmarking component of the project was rolled out. Continual improvements have been made to the tool since its' initial development, particularly after it was first trialed with users at the first series of grower workshops, where valuable feedback was received on the layout and outputs. Changes to the layout of existing graphs, the addition of new graphs and the introduction of a filtering capability (by water supply area and by mill area) into the tool were included as a result of this feedback.

The online benchmarking tool plots individual farm results against an amalgamated data set derived from all of the participating farms. This is presented using box and whisker plots which display the range of results from the highest to lowest record, the median result and the upper and lower 25% of results (upper and lower quartiles). Figure 1 below provides an explanation of how to interpret these plots.

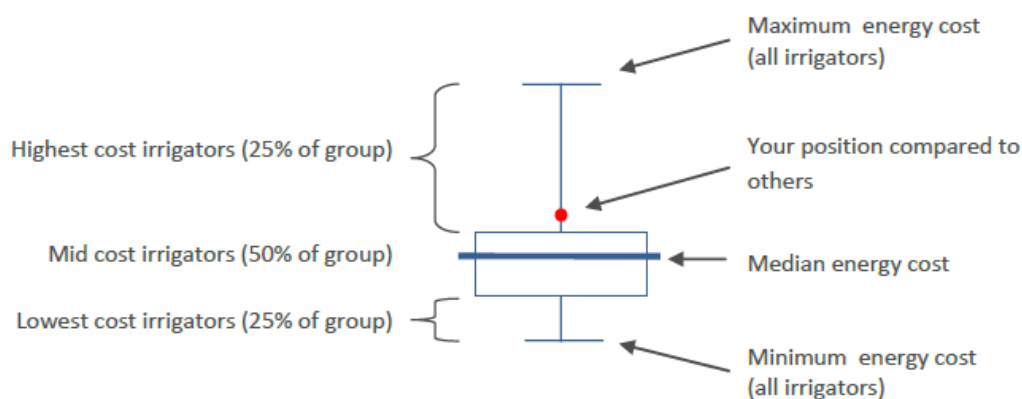


Figure 1. Guide to interpretation of box and whisker plots.

Box and whisker plots were generated for the following parameters for each farm entered into the online tool:

- Electric pump energy cost (\$) per hectare of total farm area;
- electric pump energy consumption (kWh) per hectare of total farm area;
- electric pump energy cost (\$) per harvested hectare;
- electric pump energy consumption (kWh) per harvested hectare;
- electric pump energy cost (\$) per tonne of cane produced;
- electric pump energy consumption (kWh) per tonne of cane produced;
- electric pump energy cost (\$) per tonne of sugar produced; and
- electric pump energy consumption (kWh) per tonne of sugar produced.

For public display purposes a demonstration farm (at the agreement of the owners: Inkerman Cane Growers Organisation Ltd) was used, both throughout this document and also in other public forums. Examples of the online tool outputs are included in figures 2, 3 and 4 using the demonstration farm as the "current record".

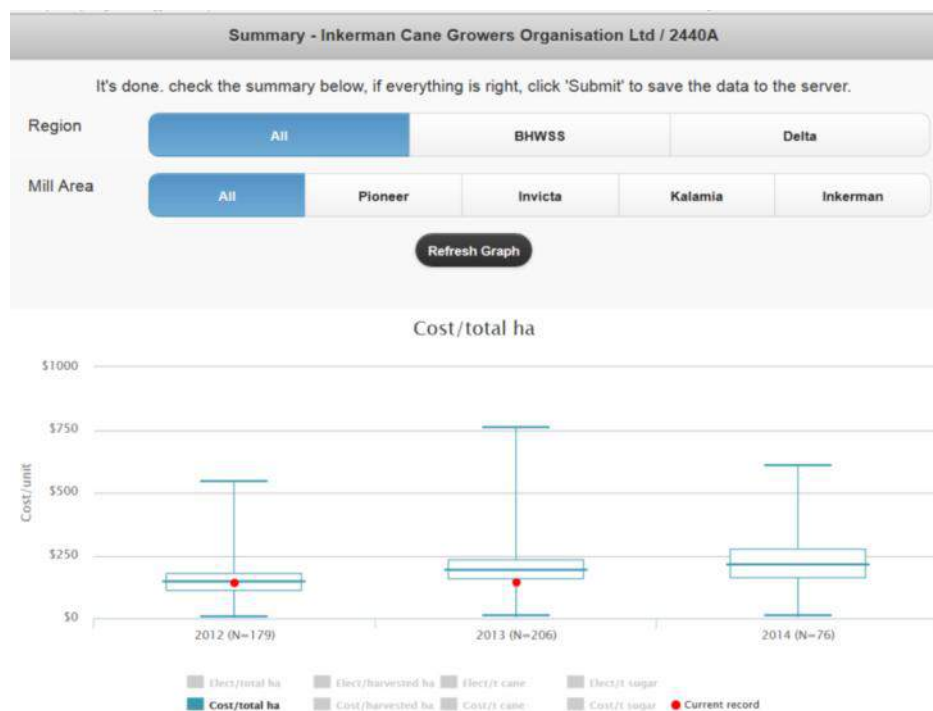


Figure 2. Electric pump energy cost per hectare for total farm area.

Figure 2 shows the box and whisker plot outputs for the electric pump energy cost per hectare from the total farm area for all participating farms (179 for the year 2012 and 206 for the year 2013) with the current record being the demonstration farm (Inkerman Cane Growers Organisation Ltd). The 2014 data has not yet been entered for this farm and hence its record does not appear in the year 2014 plot.

As demonstrated by figures 3 and 4, the online tool enables the viewer to obtain the exact figures in dollars for both the box and whisker plots, and also for their individual farm's record by rolling the mouse over the plot or the red "current record" mark.

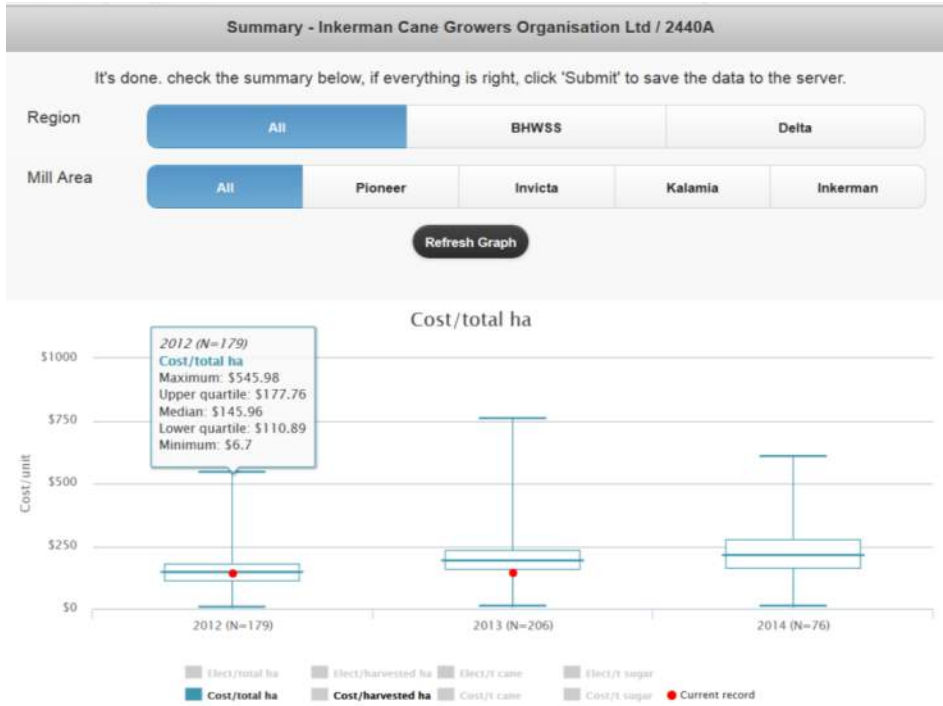


Figure 3: Exact figures for the maximum, minimum, median and upper and lower quartiles.

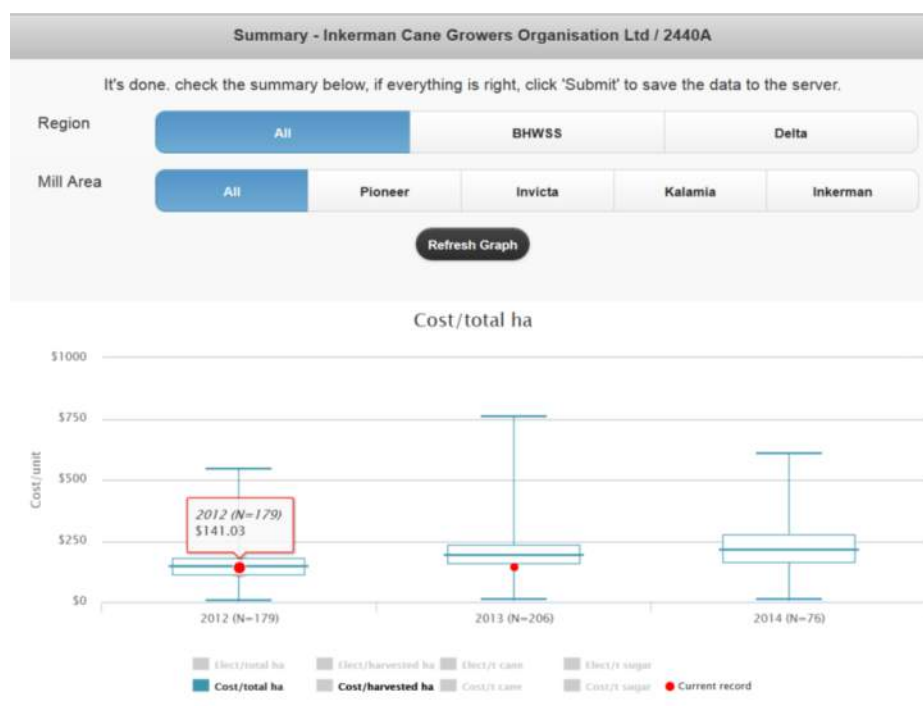


Figure 4: Individual farm results.

As can be seen from these three figures, the viewer has the option to filter the data further in order to compare themselves to similar farms by selecting their particular water supply area (Burdekin-Haughton Water Supply Scheme or the Delta area) and/or by one or more of the five mill supply areas in the Burdekin (Pioneer, Invicta, Kalamia, Inkerman). This reduces the data set and enables the viewer to compare themselves to a more appropriate grouping of like farms.

A number of other graphs are also generated by the online tool to illustrate cost and energy consumption across a farm for each individual electricity account by billing quarter.

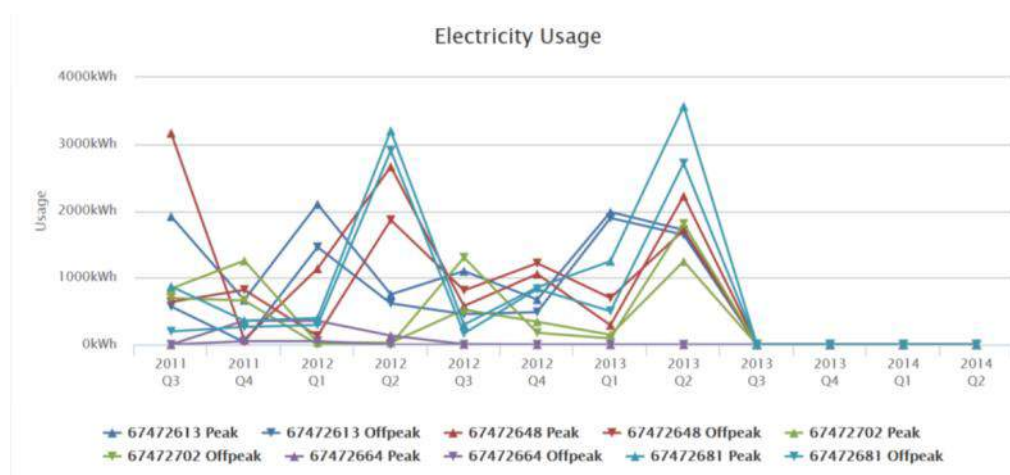


Figure 5: Electricity usage graph for each of the electricity accounts.

This graph shows the peak and off-peak usage for applicable accounts, across the demonstration farm for each billing quarter for the years entered. A similar graph is also generated showing the costs in dollars for each of these accounts.

Stacked bar graphs are also generated to illustrate the total electricity consumption and cost across the farm per billing quarter. See figure 6:

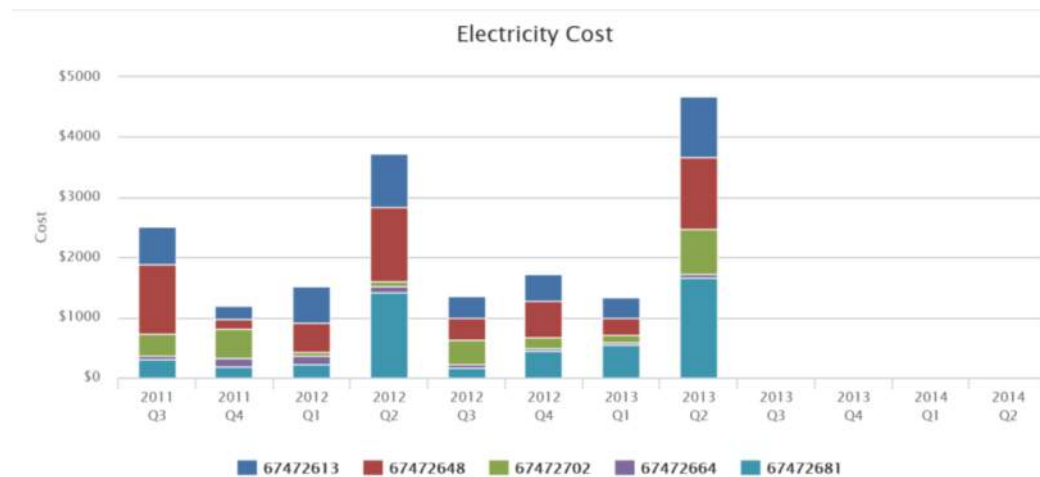


Figure 6: Electricity cost for each account per quarter

It was originally intended that diesel pump usage also be benchmarked as part of this component of the project, and the data collection method and online benchmarking tool were designed with this capability. However as the project progressed it became evident that whilst some farms do use diesel pumps, the number is very low in comparison with electric pumps and growers do not keep accurate records of the diesel consumption and costs for each of these pumps. For this reason no diesel use data has been entered to date. The capability to benchmark diesel use has been retained in the online tool, as those growers who use diesel pumps have indicated a desire to be able to benchmark their consumption in the future.

Another key parameter that was originally intended to be benchmarked was water consumption, however it quickly became evident that accurate data on water consumption was not readily available across all the participating farms. This was in part due to differences in water supply areas and water usage monitoring (for example in many areas ground water consumption is not currently measured) as well as problems with the accuracy of installed water meters (many were found to be not functioning properly). However, including water consumption and water cost is a desirable parameter and therefore this capability has been retained in the online tool for possible future use.

Another parameter that was included in the online tool but which did not yield useable data was soil type. It was soon discovered that most farms have a large variety of soil types and therefore it was difficult for farmers to nominate one major soil type. The reason for including soil type in the tool was because soil type can have a significant influence on the total water demand on a farm. Instead, the location of the farm was determined to be a better means of estimating soil type and thus water demand.

Project videos

A number of videos were also produced as part of the project. Videos were considered a powerful means of delivering information on project activities and key findings via the project website. The videos were particularly useful for demonstrating field activities and public events undertaken throughout the project.

To ensure ease of download from the website, the videos were uploaded via YouTube and were limited to approximately six minutes duration each.

The six videos developed for the project were:

1. Snapshot of the Energy Efficiency Expo held in Ayr, March 2014.
2. Demonstration of a Pump Efficiency Assessment conducted on farm.
3. Industry skills development and training in the field.
4. Satellite area workshops and field days.
5. Level 1 grower workshops.
6. Local Case Studies.

An 'expression of interest' form was used to encourage growers to make **contact with the project team** without having to commit to signing up for the project.

3.5 Project Promotion and Community Involvement Techniques

A range of different promotional and community involvement techniques were used throughout the life of the project to recruit participants. These included the use of flyers, public events, industry networks and newspaper advertisements.

Industry networks

At the commencement of the project, growers were recruited to the project through contact with BBIFMAC staff (e.g. via other BBIFMAC projects, BBIFMAC meetings and field days), word of mouth from other participating growers, and through industry and grower networks (e.g. Canegrowers Burdekin, Burdekin Productivity Services, Farmacist, Water Boards and Irrigators Committees). The industry networks enabled a much wider audience to be reached as these industry bodies have extensive grower based memberships, as well as regular newsletters and grower events which were used to promote the project. This industry support was critical to the success of the project as it also added credibility to it (growers are more likely to participate in a project if they hear about it from a range of sources and if it is supported by local industry bodies).



Above: Project and industry staff in the field.

Another key means of recruiting growers to participate in the project was through the Energy Efficiency Expo which was advertised through the local media (newspaper and radio) as well as through the BBIFMAC and industry group networks. A large number of growers signed up to participate in other aspects of the project at this event.

Expression of interest flyers

Expression of interest forms were also distributed at the onset of the project and at key stages throughout the life of the project. These flyers were distributed electronically via BBIFMAC and industry networks through email lists, electronic newsletters and on these organisations' websites, as well as through hard copies distributed at meetings and other

grower events (e.g. field days). The flyers were also distributed by local agribusiness (e.g. banks, accountants, agricultural consultants) and included in newspaper advertising.

The purpose of the Expression of Interest flyer/form was to provide an easy means for growers to express interest in being involved in the project without committing fully at the time. All a grower had to do was write their name and phone number on the form, submit it to BBIFMAC via a range of means and then a project staff member would phone them to explain the project, participation requirements and send out the necessary forms if the grower agreed to participate.

Two expression of interest forms were developed throughout the project - one at the onset of the project which highlighted the project deliverables and encouraged growers to get involved and another in September 2014. The second version of the form included quotes from farmers who had already participated and the benefits they had experienced from the project to entice new growers to get involved.

Local newspapers and industry newsletters

A powerful mechanism for promoting the project and its benefits was through local newspapers. At key project events a journalist from the local newspaper was invited to attend and cover the story. This enabled photos and quotes from participating farmers to be included which added more personal interest to the story. Local newspapers have a wide circulation and are a good means of engaging with growers not already engaged with BBIFMAC and the collaborating industry bodies. It was also a means of reaching beyond the grower audience to promote the project and its findings to the wider community. More than 20 newspaper articles were published about the project over an 18 month period.

Regular project updates were also placed in the local Burdekin Canegrowers E-newsletter "Canenews" which is a weekly publication targeting local cane farmers. An article was also published in the Australian Canegrower magazine which has a national circulation.

Grower participation rates

Figure 7 shows the impact of the promotional activities, including the Expo, on project participation and highlights the importance of such activities in generating grower involvement. The Energy Efficiency Expo was held in March 2014 and this, and the associated project promotional activities that were undertaken in its lead-up resulted in the largest number of growers signing up for the project in any one month for the life of the project.

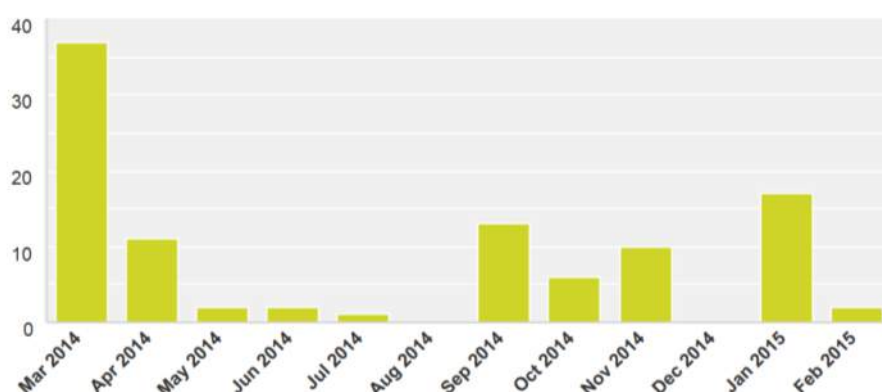


Figure 7. New grower participation over 12 months.

Grower participation decreased over time after this event and by August 2014 had almost ceased altogether so project promotional activities were revamped in September 2014 including the release of weekly newspaper articles and the distribution of a new Expression of Interest flyer through industry networks and at project events. This had an instant impact with grower numbers improving substantially for that month and the newspaper articles were continued through to December.

Publishing **quotes** from farmers who have already participated in the project helped to **entice new growers** to get involved.

Further promotional activities were undertaken in November and early December (including newspaper advertisements) which resulted in an increase in participation in November and January. As can be seen from Figure 7 participation was very low in December 2014, likely due to December being a busy time for growers with planting, watering and fertilising new crops after the crushing finished, as well as it being the lead up to Christmas period.

Grower numbers increased again in January 2015, largely as a result of an industry group sending text messages to all their member's mobile phones informing them of the need to sign up before the project closing date. Group SMS's are a proven way of reaching a large number of people instantly, provided the message is succinct enough to be conveyed in this manner. Due to privacy laws project staff were not able to access mobile phone numbers for large numbers of growers in the district, however one of the collaborating industry bodies with a large grower membership distributed the SMS to ensure their membership did not miss out on the opportunity for involvement.

4. Key Learnings and Evaluation

4.1 Engagement Program Design

The program was designed to engage growers at the grass-roots level using local, trusted personnel and organisations to distribute project materials and encourage participation. In a small, agricultural community this personal approach is proven to result in more involvement than mass mail-outs or a reliance on electronic media reaching the target audience. This certainly proved to be the case in this project where a one-on-one, industry based approach was employed at the onset as the primary means of engagement with growers.



The project used a range of simple, proven methods to facilitate grower involvement and tailored the program to local needs and events. Recognising that growers have busy schedules and that there are many competing events occurring in a small community, the project utilised existing networks and events where possible to reach growers and encourage their participation in the project.

Above: Industry staff measure an intake pipe diameter.

This would not have been achieved without the support of the industry groups and organisations in the local area. BBIFMAC's reputation within the community, industry groups and with growers was critical to securing the collaboration and support of these other organisations for the project.

Anecdotal evidence suggested that previous engagement with BBIFMAC or membership with one of the collaborating industry organisations, was a predictor of involvement in the project, as the majority of the growers who participated in the project either had previous or current involvement with BBIFMAC, and or one of the collaborating industry bodies.

This is likely due to the fact that growers are often more receptive to a project delivered by or actively supported by an organisation that they have had positive dealings with in the past and trust. BBIFMAC and the collaborating industry bodies also actively encouraged and motivated members to be involved in the project. This would likely have also been a contributing factor as it is often the case that growers need to be reminded numerous times and encouraged via multiple means before they'll commit to involvement.

An important consideration was ensuring flexibility within the engagement program and engagement process to respond to local needs. Flexibility of program involved designing the timing and location of events to work in (where possible) with growers' availability (e.g. avoiding the busier times in the growing or harvesting season, and responding to changes in grower availability due to weather influences).

This had to be balanced with the milestone reporting requirements for the project and consequently in this restricted the amount of flexibility available for some of the project activities.

Another key aspect of engagement program design was ensuring flexibility of process. As with most projects some aspects of the program were changed as they were rolled out when it was discovered that improvements could be made to the process and that they could be better tailored to participant needs. These changes occurred in part as a consequence of participant feedback, and as a result of the philosophy of continual improvement throughout the life of the project.

A key desirable outcome for the project was to deliver a program that provided opportunities for continual engagement with growers over the life of the project, rather than a series of 'once-off' opportunities. By implementing a range of project activities and opportunities for involvement, some concurrently and some in succession this was able to be achieved. Growers who had already participated in earlier project activities (e.g. whole-of-farm energy benchmarking) were able to build upon those experiences through follow-on project activities which enabled a more detailed look at specific elements of energy use on their enterprise (e.g. individual pump or irrigation efficiency assessments).

Ease of participation was a primary aim in developing the process for engagement with growers. Acknowledging that growers are always time poor, all aspects of the project involving grower input were streamlined as much as possible. For example the data collection and assessment processes were designed such that growers had minimal tasks to complete, and the majority of the effort was conducted by project staff. Forms requiring grower input (data collection forms, participant surveys etc) were designed with emphasis on ease of completion and restricted to no more than 2 pages in length.

Keeping project application forms short and simple helped to encourage growers to get involved in the project (when they realised participation was not time-consuming or onerous) and also helped to ensure a higher rate of completion and more timely return of the forms to project staff. The layout and questions in the forms were also continually revised to improve clarity and remove obsolete questions.

'Ease of participation' was a key consideration in the design of the **engagement program** in order to maximise grower **involvement** and **timely input**.

4.2 Limitations and Barriers to Involvement

There are a number of factors which potentially limited grower participation in the project, and the uptake of information as a result of the project. These included existing attitudes about government funded programs and distrust of data collection processes, the perception that the project has nothing new to offer them and the influence of other factors such as time constraints, and low computer literacy levels.

Existing attitudes about government funded programs and the level of trust for such programs can influence a grower's willingness to participate in a project, regardless of the respect they may have for the local organisations delivering it and the potential positive outcomes of the project. Previous negative experiences with government funded projects can leave a legacy of distrust with individuals and whole communities. It is difficult to quantify to what extent this may have been a factor in this project, however it is likely that this may have been a factor in some growers' decisions not to be involved in the project.

While the project met its target numbers for participation, there were some growers who declined the invitation to participate due to distrust with the process. This concern related to the collection of their energy consumption and billing data and a fear of the release of this data and the results of their energy assessments to other third parties (such as government bodies or the energy provider), despite project team assurances of data protection and confidentiality.

Another barrier to participation and information uptake was the perception held by some growers that their enterprise is doing as well as it can be with regards to irrigation energy efficiency and that there was nothing that the project can do to improve their situation. For this group of farmers, a firm belief that because they were doing "a pretty good job" with the management of their crop, i.e. growing high yielding crops, they were "probably doing a pretty good job" with other aspects of their management. For these successful and profitable farmers, the thought that they may be able to make changes that would result in significant cost savings had never crossed their minds.



Above: One of the Case Study participants on his farm.

Whilst rising electricity and irrigation water charges were a key motivating factor for many growers to participate in the project, for others the solution was seen to be in lobbying for lower charges. Changes to on-farm practices and improvements in technology were seen by some to be of less concern than the current, and proposed future energy pricing structure in the region and the need to lobby government for a reduction in irrigation tariff prices.

Outside influences such as time constraints and low computer literacy levels, particularly in the older generations were also key factors limiting the involvement of some sectors of the grower community. All growers are time poor and the key to maximising their involvement is timing events to coincide with those periods of the year when they are less busy. However an increasing number of younger generation growers are now relying on off-farm income to supplement their farm income, and are extremely difficult to engage. To address this issue the project kept workshops and other events to as minimal duration as possible and always offered a range of times and days of the week for participants to choose. For those who could not attend workshops, personal one-on-one consultations were offered.

Low computer literacy levels in the older generation was a limiting factor for the involvement and uptake of information in that sector of the community. Some growers were reluctant to get involved in project activities that involve the use of a computer and were unable to source information from the internet. To address this issue the project team ensured training and assistance in the use of the computer based tools were provided to all participating growers and invited other members of the business or family to also attend the workshop and gain the necessary skills. In addition, growers' level of confidence with using the tools after receiving this training was assessed so that further assistance could be provided if required.

4.3 Identifying and Addressing Knowledge Gaps

One of the key challenges for the project was identifying and addressing knowledge gaps in the irrigation community and tailoring the available information to fill those gaps. While a plethora of information exists about energy efficiency for pumps and irrigation systems, it can be difficult to find and is often not provided in grower friendly language.

It also became evident in the early stages of the project that much of the available information on energy efficiency in irrigation was not broadly applicable to the local situation. For example many of the systems investigated through other studies were high pressure systems with different types of pumps and irrigation configurations to those commonly used in the Burdekin.

This meant that local growers found it difficult to differentiate between those recommendations that were applicable to them and those that were not. There was also a degree of conflict in some of the literature available further complicating the task for growers trying to obtain the necessary information.

It was also identified there were some common myths accepted as fact amongst the irrigation and professional community. Many growers rely on the advice of their local pump supplier or boring contractor who are not always equipped to advise on the more involved aspects of energy efficiency and irrigation performance. A key task therefore for the project was to correct false information, identify the key areas where information gaps existed and develop the necessary tools to address them. This included participant surveys to gauge the

current level of knowledge of local growers and target project activities to those areas commonly lacking.

Methods employed to address the knowledge gaps once identified included developing project Fact Sheets addressing commonly asked questions, using local Case Studies to highlight common on-farm issues and methods of addressing them, presentations and field demonstrations on key topics of interest to growers and conducting industry skills development sessions with local industry staff. These activities were extremely well received with many growers indicating that they had been seeking this kind of information for some time and were pleased that they were finally able to receive advice that was relevant to the area and from a trusted source.

One-on-one consultations with project consultants was another key means of imparting knowledge to local participating growers and was also well received. Unfortunately budgetary constraints meant that this direct consultation was not able to be offered to all participating farmers and was restricted to one pumping situation per farm for the more than 30 farms for whom an assessment was conducted (see individual pump and irrigation efficiency assessments).

Identifying the extent to which the project addressed the identified gaps in knowledge was also a challenge, as conveying information and imparting knowledge to growers on a subject does not always immediately result in immediate actions or changes to behaviour. This can be due to a number of reasons unrelated to the project, primarily being a lack of financial resources to upgrade or purchase infrastructure and equipment, as well as a lack of time to change management practices in the short term. The key desired outcome of the project was however to enable growers to make better informed decisions when they next upgrade or replace equipment and infrastructure, or consider management changes.

The success of the program was both formally and informally measured. Informal measures of success included the positive nature of personal feedback received from growers at project events and also the number of follow-up enquiries and contact growers had with BBIFMAC as a result of the project. Project staff were also able to gauge the extent of increased awareness and knowledge in individual growers by the nature of their enquiries and discussions.

As a more formal means of measuring the success of the project in raising growers awareness and knowledge of energy efficiency issues and options, before and after surveys were conducted with participating growers at key junctures of the project.

This enabled the success of the project in addressing knowledge gaps to be assessed as well as enabling efforts to be directed to those areas in most need of additional effort.

Both the formal and informal measures of success provided confirmation to the project staff that the method of delivery for this project was a success.

To maximise **completion rates** for surveys limit them to a maximum of one page and distribute and collect them at **project events**.



Above: A participating farmer.

4.4 Participant Feedback

Pre-involvement survey

A pre-involvement survey was circulated to all 121 growers who signed up for the project. The intent of this was to gauge growers' level of knowledge and awareness of key energy efficiency issues so that the program content could be designed to address major gaps. A total of 101 surveys were returned (the survey was optional), a response rate of 83%. The surveys were distributed to growers along with the project application forms.

There were 15 questions in the survey which covered three major areas; participant awareness, knowledge and attitudes. The results of this survey are discussed below:

When respondents were asked how aware they were of the increased cost of energy on their enterprise, a large proportion (89%) responded that they had a 'very high' level of awareness of the increased costs. A much lower proportion (50%) however indicated they had a 'very high' awareness of the proportion of energy costs used in irrigation compared to their total farm energy costs. A similar response was received for subsequent questions asking for participants' level of awareness of the implication of irrigation efficiency and the impact of pumps and infrastructure on their energy use. Less than 52% of respondents indicated that they had a 'very high' level of awareness of these factors.

Awareness levels dropped further when respondents were asked what level of knowledge they had about the EEGAI project and how to improve their irrigation and pumping efficiency to reduce costs. The majority of respondents indicated that they felt they only had a 'moderate' knowledge of these areas.

The lowest level of knowledge indicated by respondents was in relation to tariffs with close to 30% of respondents advising that they had a 'low' knowledge of tariffs and where to access information on them and 12% indicating that their knowledge was 'very low'.

Most participants felt there was merit in findings ways to reduce energy costs and were motivated to take action to reduce energy costs, including participating in the EEGAI project and examining other ways to reduce energy usage.

A post-involvement survey will also be conducted at the end of the project to gauge the extent to which the project initiated an increase in participants' knowledge and understanding of energy efficiency on their irrigation enterprise and in irrigation generally.

Participant feedback surveys were also conducted at the conclusion of several of the key events of the project. Participants were provided with a feedback form and asked to complete it and return it to a project staff member before leaving the venue. The survey responses were then collected by project staff and entered into Survey Monkey for collation and analysis. The primary purpose of these surveys was to gauge the effectiveness of key project activities in raising participant awareness and knowledge of energy efficiency measures and also to assist in tailoring future project events to participant needs.

The results of this survey are included in Appendix A.

Energy Efficiency Expo participant survey

The first event from which feedback was obtained was the Energy Efficiency Expo held in Ayr in March 2014. The surveys were distributed prior to the conclusion of the event and were collected as participants left the venue. Overall 58 of surveys were returned from this event, a response rate of 41%. A total of eight questions were asked in this survey. The first three questions asked about the venue, the expo content and the information materials provided, and the remainder of the questions gauged attendees level of knowledge and awareness before and after the event.

The survey results showed that the majority of respondents felt that the venue was comfortable, well located and that food and refreshments were adequate. With regards to expo content, the majority believed that it was relevant, comprehensive and easy to understand. Responses to the survey also indicated a high level of satisfaction with the information materials provided at the event.

Respondents were also asked to indicate their opinion of the energy efficiency of their irrigation enterprise. The majority of respondents indicated that they believed their energy efficiency was fair or good. Very few indicated that their energy efficiency was poor or excellent and a small number indicated that they didn't know what to rate their enterprises' energy efficiency.

The remaining six questions sought to quantify what changes in respondents' knowledge and awareness had occurred as a result of the event. The results show that a large increase in participants' level of awareness and understanding of the options for improving energy efficiency on their enterprise, the tools and techniques available and the tariff options had occurred as a result of the event. The results of this survey are provided in Appendix B.

Extremely positive feedback was received from growers who attended the Energy Efficiency Expo. One of the comments received on the project website after the event is included below:

"Thank you for organising the recent energy efficiency forum held at the Ayr show grounds. I must admit I went along with the cynical attitude that it was just a token milestone requirement for the project but left telling everyone I saw what they'd missed by not going. The subject matter was very relevant and the speakers over delivered on what I was expecting to come home with. There is a huge potential for all involved to benefit greatly from the exchange of information...from suppliers of products and services to end users to industry. I was very impressed and have heard lots of positive comments from others who attended. Keep up the good work and I look forward to seeing more come out of this project in the future."



Above: Irrigation services consultant Merv Jessen works with a grower.

Grower workshop surveys

Similar questions were asked of participants at the whole of farm benchmarking grower workshops. Overall 79 feedback forms were received from 93 participants, a response rate of 85%. A total of 13 questions were included in this survey and as was found in the Energy Efficiency Expo survey, respondents reported an increase in their knowledge and awareness of energy efficiency options and measures as a result of the workshop. At these workshops participants were also asked whether the workshop content was relevant, well presented and easy to understand. For all of those questions the majority of respondents (more than 88%) strongly agreed with the statements.

Participants were then asked whether they were likely to implement any actions as a result of the workshop to which 88% indicated they would. When asked whether they felt confident using the presented tools independently into the future 91% of respondents responded that they felt confident. They were also asked to indicate whether there were any topics worthy of follow-up information or workshops to which 38 people provided detailed suggestions.

The results from this survey are included in Appendix C.

Additional feedback was received from participants during and after the workshop. Some of the comments received included:

"This was an extremely valuable exercise - it was really beneficial to me - I think all growers should get involved".

"The workshop was very informative. It answered a lot of our questions. This will be great because we can do it at home now any time we want into the future and continue to monitor our energy usage and make sure we are doing the correct thing".

"This has been a real eye-opener for me - I never really knew how I compared to others in terms of pumping costs."

Industry staff skills development survey

A survey of industry staff training recipients was also undertaken after the first pump efficiency training session to determine whether the training was adequately addressing their needs and expectations in order to better design the future training sessions and target knowledge gaps. The results of this initial survey showed that students were generally more confident in the use of the field equipment and taking field measurements than they were analysing the data and providing recommendations on the findings. This was to be expected given the level of skill required to undertake the data analysis and recommendations component of conducting a full pump efficiency assessment. An 'after' survey is yet to be conducted with participants who completed the entire skills development three session course.

Please refer to Appendix D for the results of this first skills development participant survey.

Satellite area information sessions and field days

Unfortunately due to administrative and staffing limitations at these locations, surveys were not conducted at the information sessions held in the satellite areas or at the field days conducted as part of the project. Had these surveys been conducted they may have yielded interesting information on knowledge and attitude differences in the different geographic areas and industries.

5. Summary

Project Strategy

The aim of the “Energy Efficiency Gains for Australian Irrigators project” was to both develop and demonstrate an effective methodology to engage and supply relevant, quality information to irrigation farmers. Ultimately, if effective, this method of engagement and information transfer would result in improving energy efficiency at farm level, savings in production costs, and increased sustainability of the SME enterprise.

The BBIFMAC project team, drawing on their considerable experience and understanding of where and how the farmers typically sourced their information, mapped out a strategy to implement that would strengthen the capacity of the Australian irrigators to adopt improved energy efficiency practices on their enterprises.

The strategy involved a multi-pronged approach, and included the following components:

- Form a technical steering group, and a separate governance committee to oversee the project progress and performance;
- Collaborate and partner with a range of local industry organisations and irrigation experts;
- Implement a carefully planned promotion and engagement process, which included hosting meetings and workshops to engage farmers and industry face to face;
- Source and present expertise and information and that would be relevant to the individual farmer.;
- Develop computer based tools, and hard copy documents such as fact sheets and case studies; and
- Effective documentation and reporting of the engagement process, which included reports and videos.

Evaluating Project Achievements

The relative success or effectiveness of the project can be gauged by posing and answering the following questions:

1. Was the engagement process effective?
 - *The public expo early in the project was attended by 141 farmer/irrigators and industry representatives.*
 - *The project was successful in engaging more than 220 SME's in the Burdekin area and many others in the satellite regions.*
 - *A total of 15 small group workshops were attended by 93 farmers/irrigators, with each workshop being fully booked and requests for more workshops.*
 - *Field days and workshops in satellite regions were attended by more than 120 farmers/irrigators.*
 - *Training sessions attracted local industry participants, each committing to four sessions over an eight month period.*
 - *SME's continue to contact the EEGAI project team for advice on energy related matters.*

2. Was the information provided relevant to the farmers?
 - *Farmers now understand and believe that they have the ability to influence their on-farm energy efficiency.*
 - *The expo questionnaire indicated a very positive response from attendees.*
 - *More than 90% of the workshop session attendees were very satisfied and appreciative of the information provided.*
 - *Anecdotal and verbal feedback from workshops and field days was very positive.*
 - *Trainees at skills training workshops were prepared to commit to an additional eight days of training after the success of the initial three day training session.*
 - *A very high level of interaction between the presenters and the SME participants at each activity with many people still actively engaged an hour after the workshop/field day/seminar was concluded.*

3. Did the project result in increased on-farm energy efficiency?
 - *The tariff calculator tool showed many farmers that they were not on the most suitable tariff for their situation, and the necessary tariff adjustments were made.*
 - *The result in changing tariffs saved farmers hundreds and sometimes thousands of dollars in energy costs per billing quarter.*
 - *The case studies demonstrated significant energy savings with the recommended changes made following the assessments.*
 - *Most irrigators now have a much higher awareness and appreciation of how much impact the following have on their farm's energy costs:*
 - *Tariff choice,*
 - *Pump maintenance and operation,*
 - *Irrigation management, and*
 - *Irrigation efficiency.*

4. Is the engagement process relevant, and transferrable to other irrigation areas in Australia?
 - *The barriers to farmers accessing and or accepting information that would build their capacity are similar across industry and geographical boundaries.*
 - *The principles of engagement adopted by the EEGAI project therefore, generally apply to farmers Australia wide.*
 - *The farmers in the satellite areas were engaged successfully, despite their farming and irrigation systems being quite different from the focus area in the Burdekin.*
 - *Industry representatives from satellite regions have approached the project team to discuss opportunities for continuing and/or building these activities beyond the life of the project.*

APPENDIX A. Pre-involvement Survey

Q1 How aware are you of the increased cost of energy on your enterprise?

Answered: 101 Skipped: 0

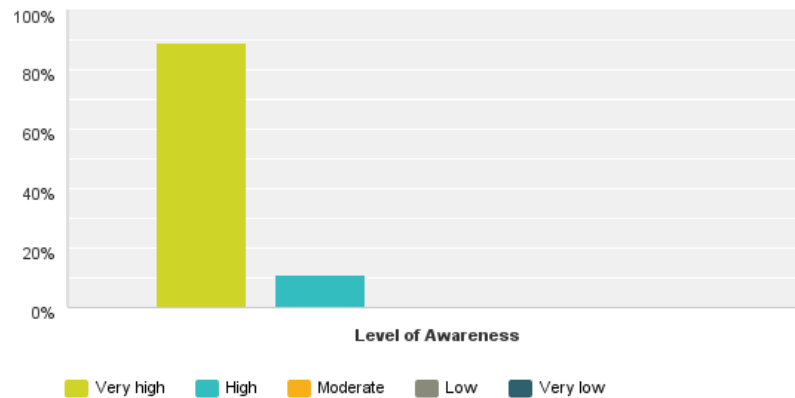


Figure 1. Participant awareness of the increased cost of energy on their enterprise.

Q2 How aware are you of the proportion of energy costs for irrigation compared to the total farm energy costs?

Answered: 100 Skipped: 1

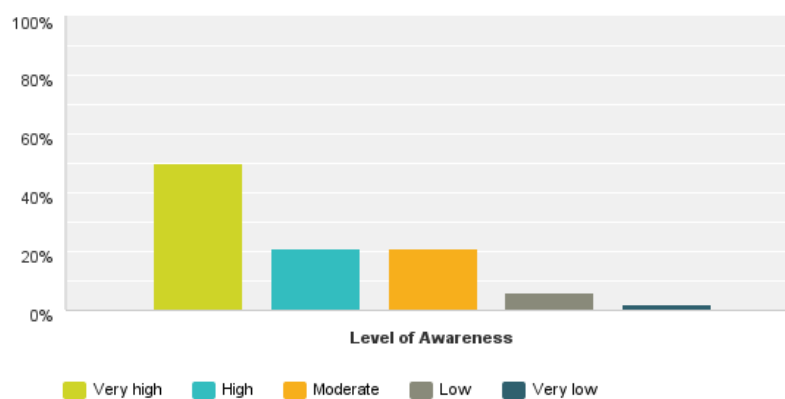


Figure 2. Participant awareness of the proportion of energy costs for irrigation on their farm.

Q3 How aware are you of the implication of irrigation efficiency on your energy use?

Answered: 97 Skipped: 4

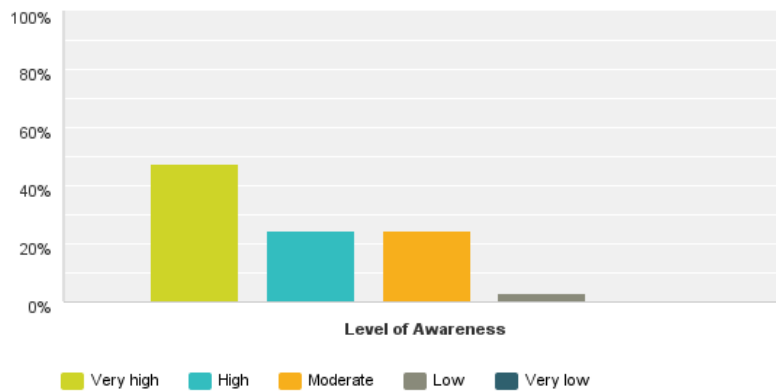


Figure 3. Participant awareness of the implication of irrigation efficiency on farm energy use.

Q4 How aware are you of the impact of pumps and infrastructure on your energy use?

Answered: 99 Skipped: 2

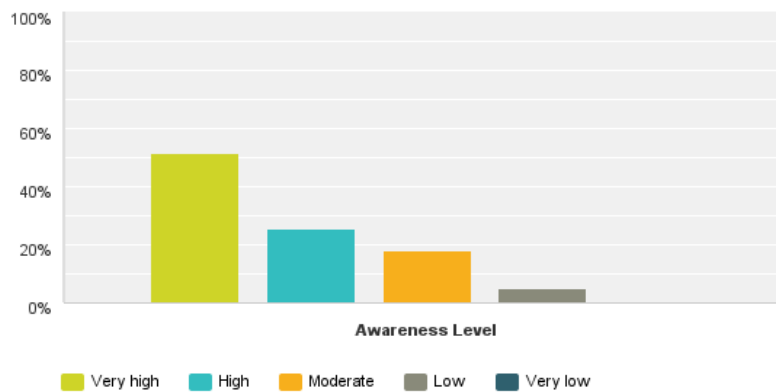


Figure 4. Participant awareness of the impact of pumps and infrastructure on farm energy use.

Q5 How aware are you of the EEGAI Project and what it plans to do?

Answered: 96 Skipped: 5

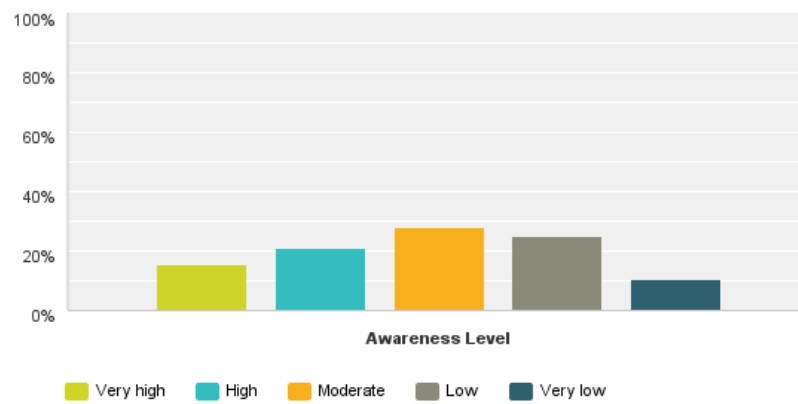


Figure 5. Participant awareness of the EEGAI project.

Q6 How aware are you of the various energy tariffs?

Answered: 97 Skipped: 4

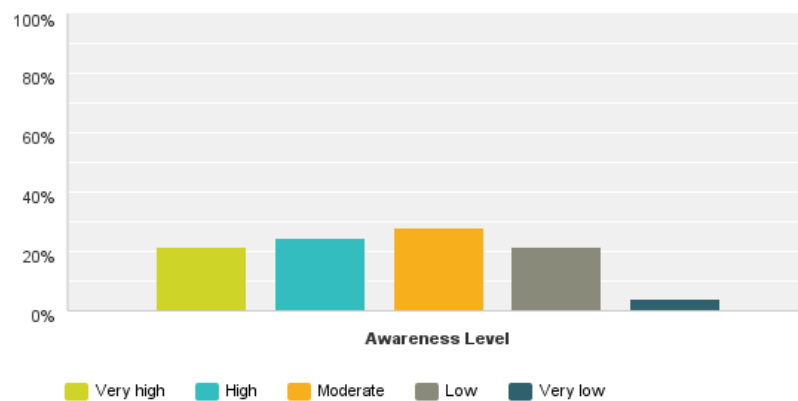


Figure 6. Participant awareness of the various electricity tariffs.

Q7 What level of knowledge do you have of how to improve your irrigation efficiency?

Answered: 101 Skipped: 0

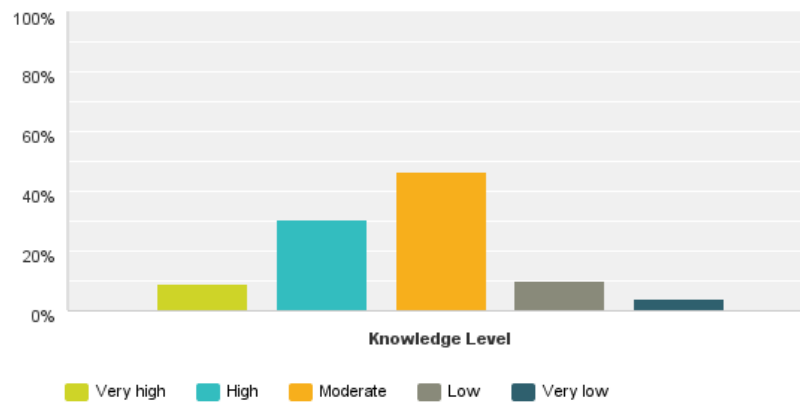


Figure 7. Participant knowledge of how to improve irrigation efficiency.

Q8 What level of knowledge do you have of the type and efficiency of the pumping infrastructure on your enterprise and how it could be improved to reduce your energy costs?

Answered: 101 Skipped: 0

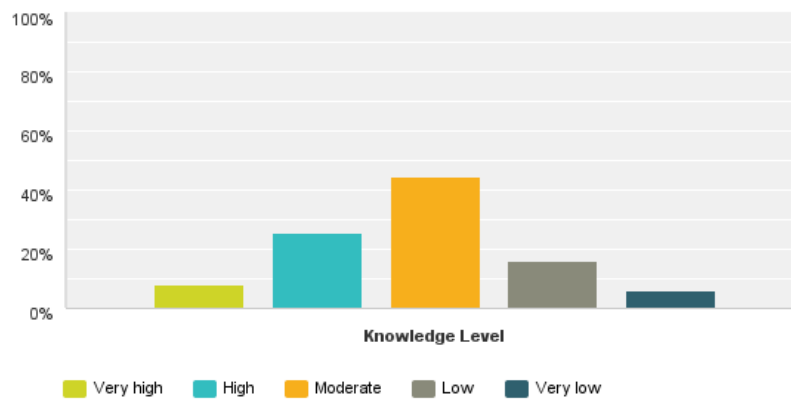


Figure 8. Participant knowledge of the type and efficiency of pumping infrastructure on their enterprise

Q9 What level of knowledge do you have of your irrigation water delivery system and method and how it could be improved to reduce your energy costs?

Answered: 100 Skipped: 1

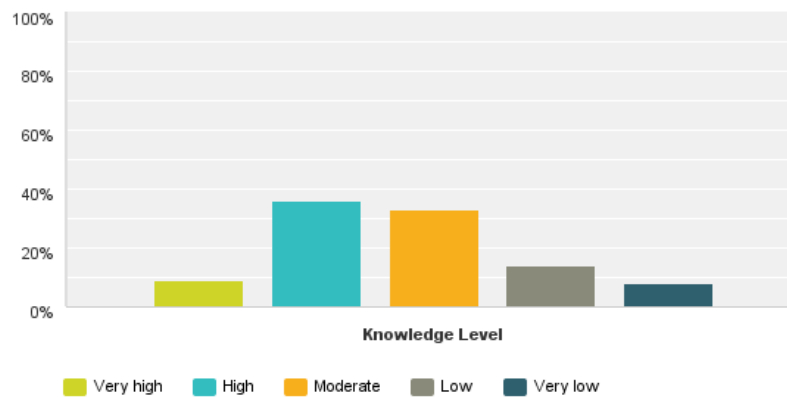


Figure 9. Participant knowledge of their irrigation water delivery system and method.

Q10 What level of knowledge do you have of the various tariffs and how to use them to minimize your energy consumption?

Answered: 101 Skipped: 0

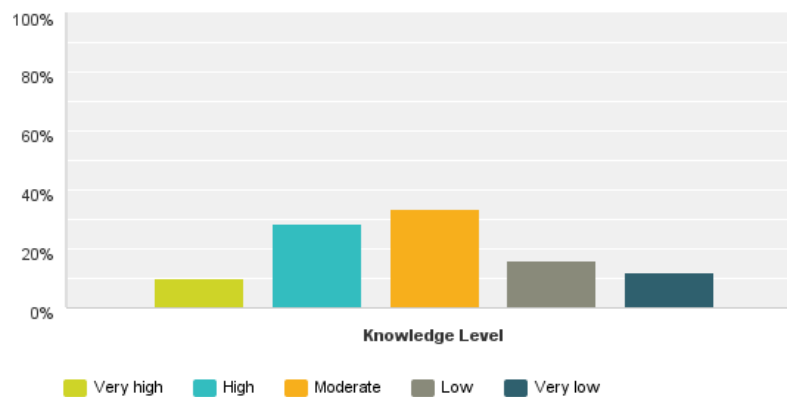


Figure 10. Participant knowledge of the various tariffs and how to use them.

Q11 What level of knowledge do you have of where you can access information on tariffs to reduce your energy costs?

Answered: 101 Skipped: 0

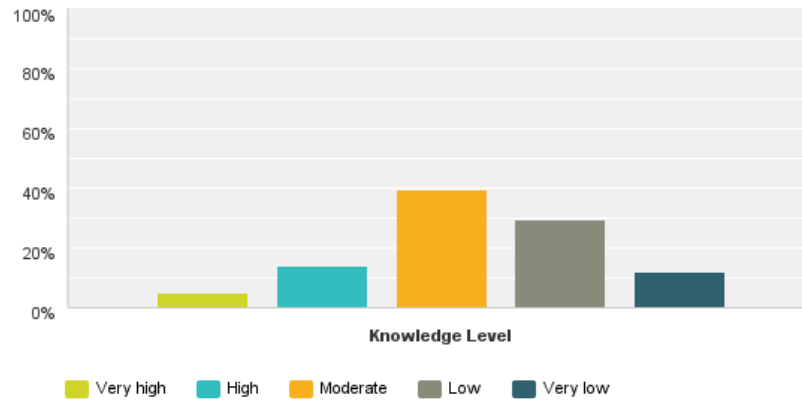


Figure 11. Participant knowledge of where to access information on tariffs.

Q12 Do you feel there is merit into looking for ways to reduce your energy costs?

Answered: 101 Skipped: 0

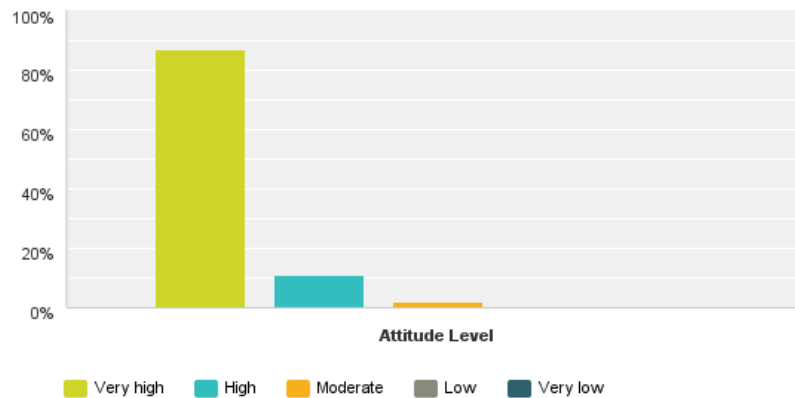


Figure 12. Participant attitude towards reducing energy costs.

Q13 Are you inclined or motivated to do something to reduce your energy costs?

Answered: 100 Skipped: 1

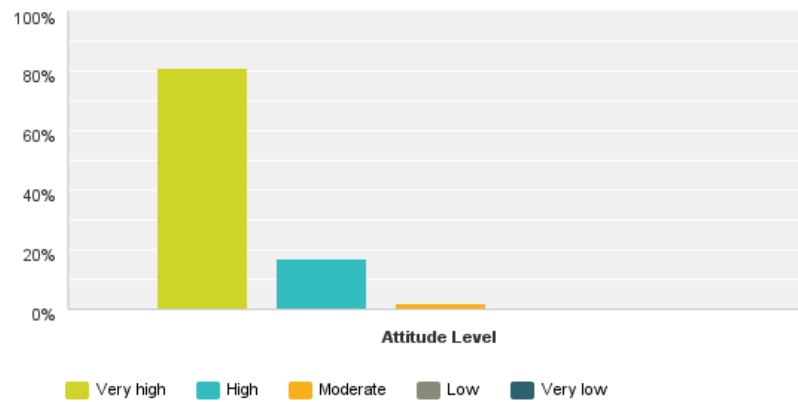


Figure 13. Participant motivation to reduce energy costs.

Q14 Do you feel it would be worthwhile to participate in the EEGAI Project's first level benchmarking exercise?

Answered: 101 Skipped: 0

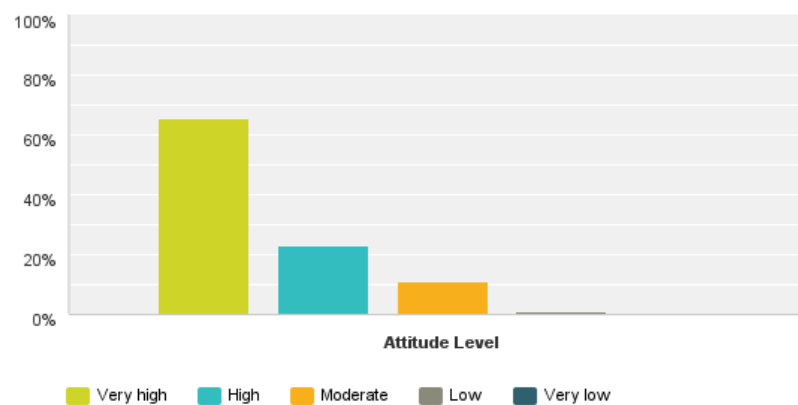


Figure 14. Participant attitude towards EEGAI level 1 benchmarking exercise.

Q15 Depending on the outcome, would you be interested in further participating in examining ways to reduce your energy usage?

Answered: 101 Skipped: 0

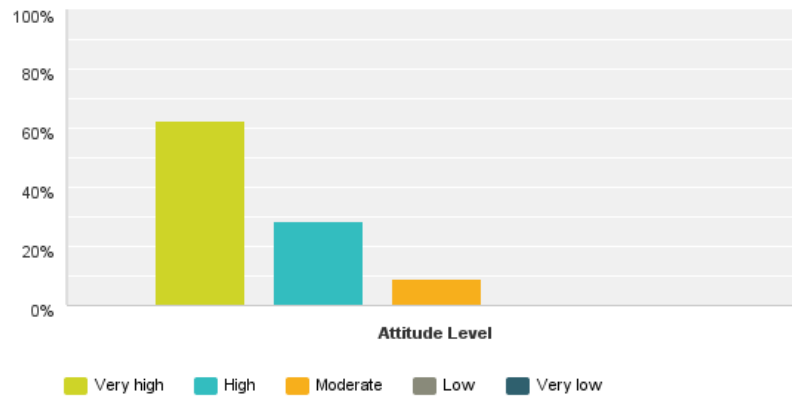


Figure 15. Participant attitude towards examining ways to reduce energy usage.

APPENDIX B. Energy Efficiency Expo Survey

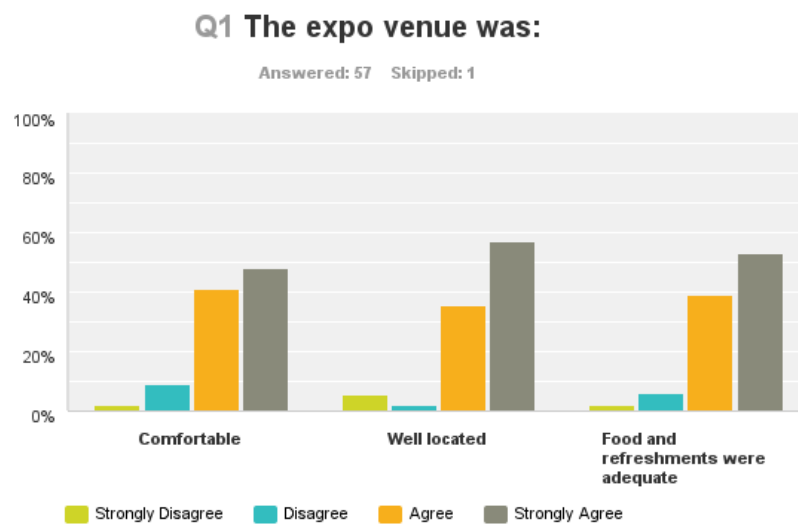


Figure 1. Participant feedback on Expo venue.



Figure 2. Participant feedback on Expo content.

Q3 Expo information materials:

Answered: 57 Skipped: 1

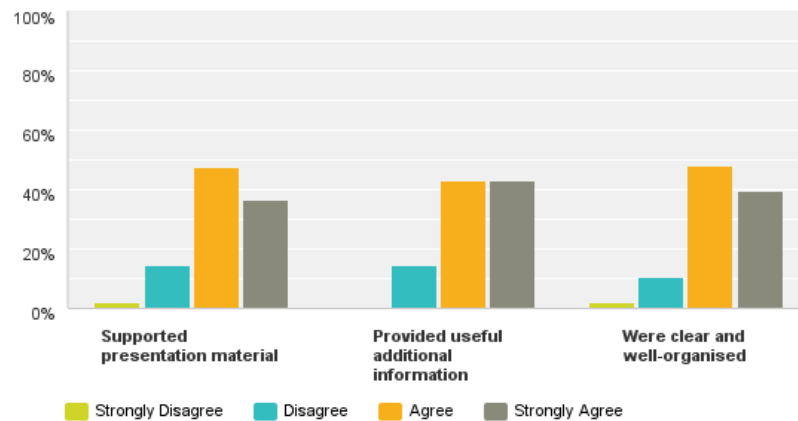


Figure 3. Participant feedback on Expo information materials.

Q4 How do you rate your energy efficiency on your irrigation enterprise overall?

Answered: 52 Skipped: 6

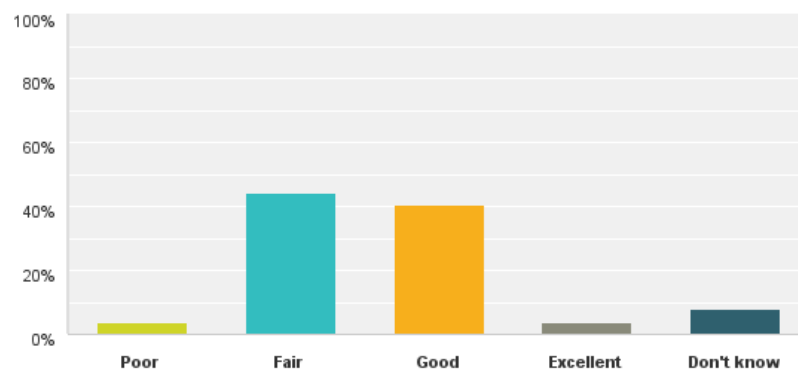
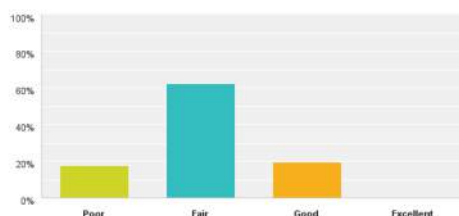


Figure 4. Participant rating of their farm's energy efficiency.

Q5 Your awareness & understand of the option you have to improving irrigation efficiency on your farm(s) before the workshop?

Answered: 56 Skipped: 2



Q6 Your awareness & understand of the option you have to improving irrigation efficiency on your farm(s) after the workshop?

Answered: 53 Skipped: 5

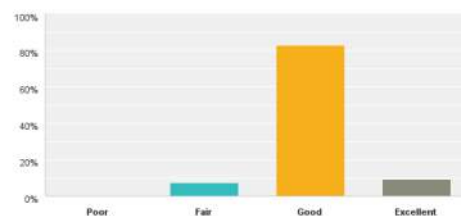


Figure 5. Participant awareness and understanding of the options for improving irrigation efficiency before and after the workshop.

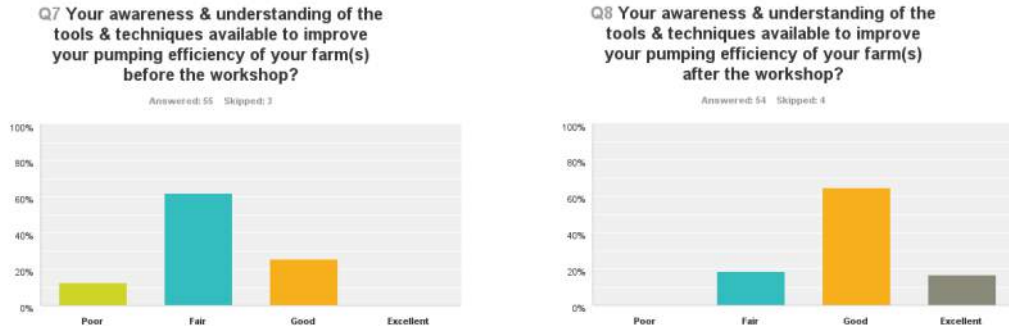


Figure 5. Participant awareness and understanding of the tools and techniques for improving pumping efficiency before and after the workshop.

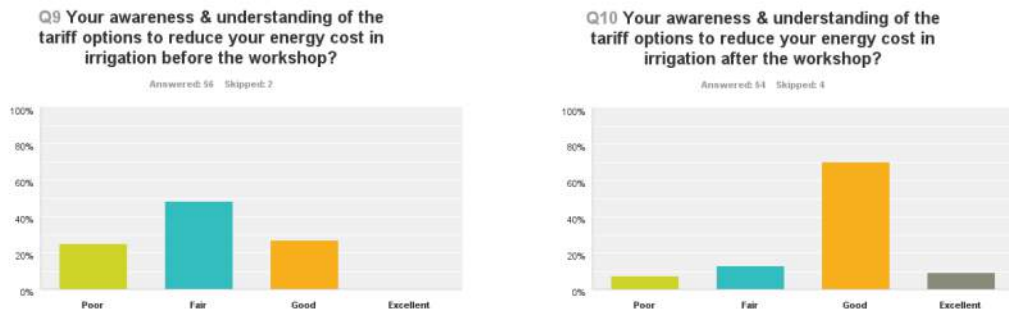


Figure 6. Participant awareness and understanding of the options for reducing energy cost in irrigation efficiency before and after the workshop.

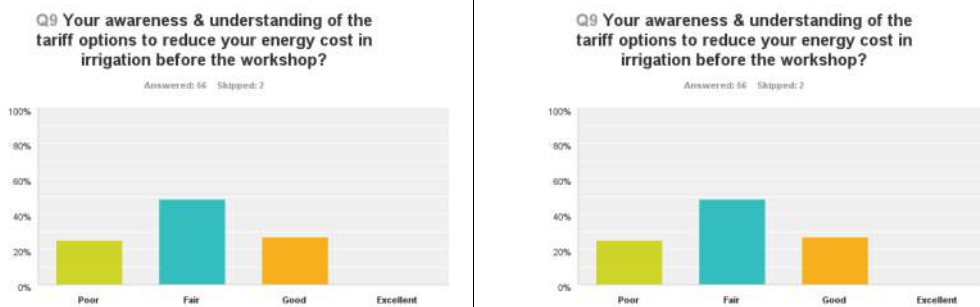


Figure 7. Participant awareness and understanding of the tariff options for reducing energy cost in irrigation efficiency before and after the workshop.

APPENDIX C. Small Group Workshop Survey

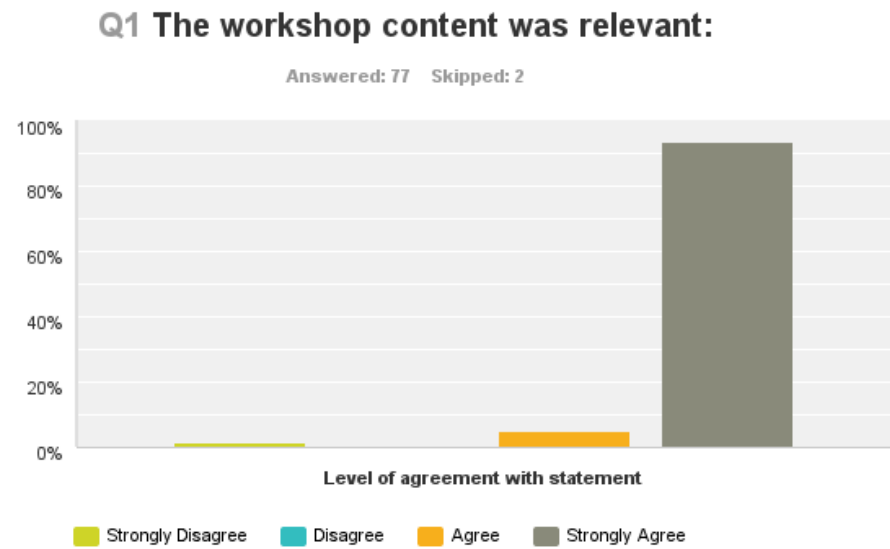


Figure 1. Participant views about workshop content

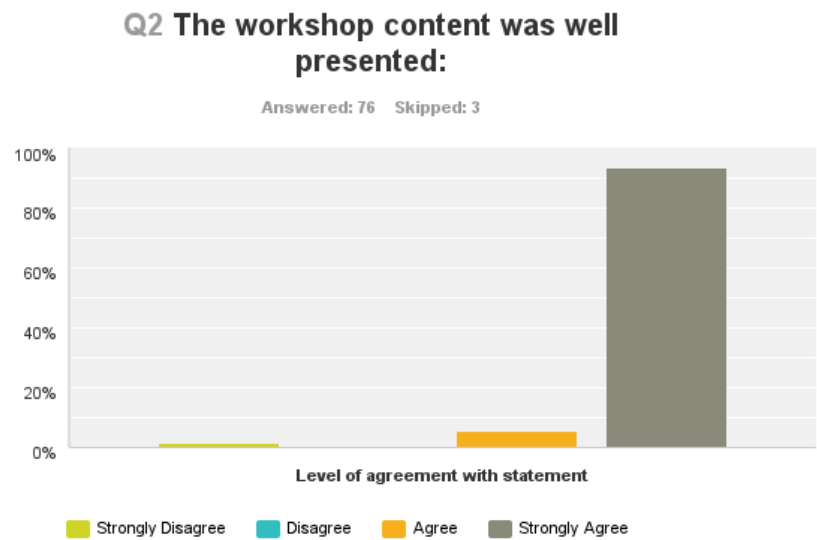


Figure 2. Participant views about workshop presentation

Q3 The workshop content was easy to understand:

Answered: 77 Skipped: 2

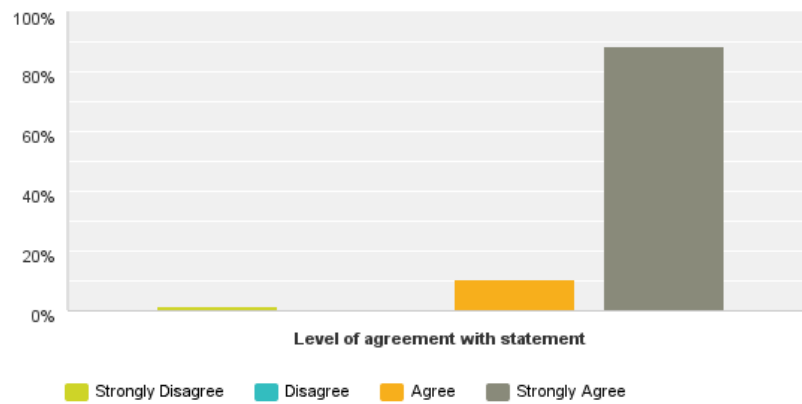


Figure 3. Participant views about ease of understanding workshop.

Table 1. Question 4. Are there any topics you think are worthy of follow-up information or workshops. A total of 38 people responded to this question.

Suggested topic	No. Respondents
Pump efficiency	12
Electricity fariffs	6
Irrigation application efficiency	5
Best practice	2
Energy efficient technologies	2
Bore design and maintenance	2
<i>Other</i>	9

Q5 How do you rate your energy efficiency on your irrigation enterprise overall?

Answered: 79 Skipped: 0

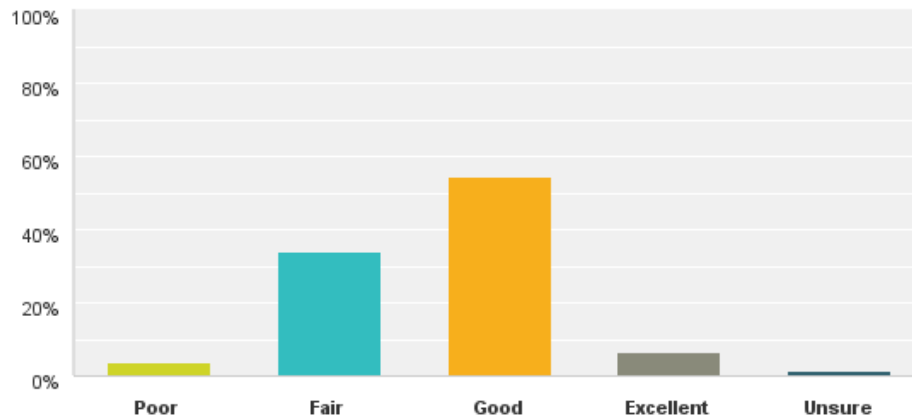
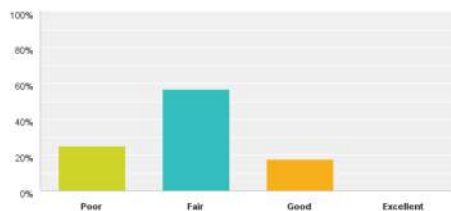


Figure 5. Participant rating of their energy efficiency.

Q6 Your awareness & understanding of your on-farm energy efficiency, before the workshop:

Answered: 79 Skipped: 8



Q7 Your awareness & understanding of your on-farm energy efficiency, after the workshop:

Answered: 79 Skipped: 8

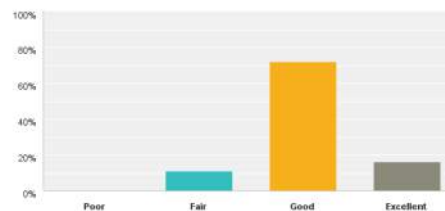
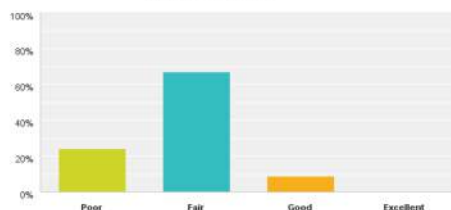


Figure 6. Participant awareness and understanding of their farm's energy efficiency before and after workshop.

Q8 Your awareness & understanding of the options you have to improve your energy efficiency on your farm(s), before the workshop:

Answered: 79 Skipped: 8



Q9 Your awareness & understanding of the options you have to improve your energy efficiency on your farm(s), after the workshop:

Answered: 78 Skipped: 1

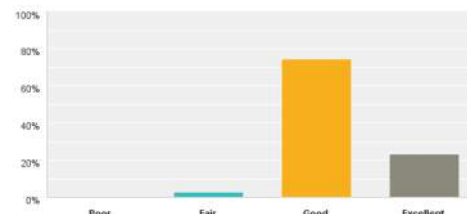


Figure 7. Participant awareness and understanding of the options for improving energy efficiency on farm before and after the workshop.

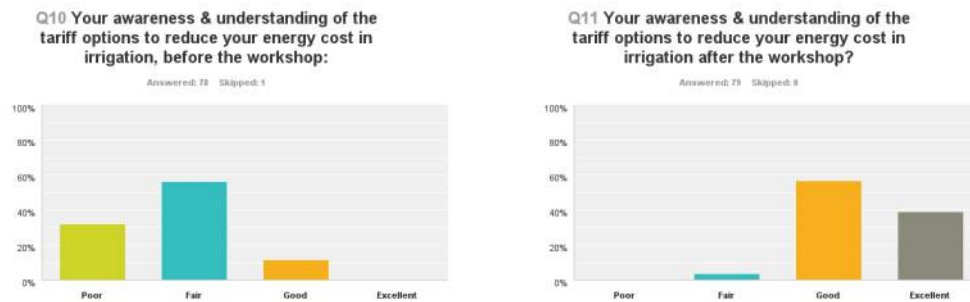


Figure 8. Participant awareness and understanding of the tariff options to reduce energy cost before and after the workshop.

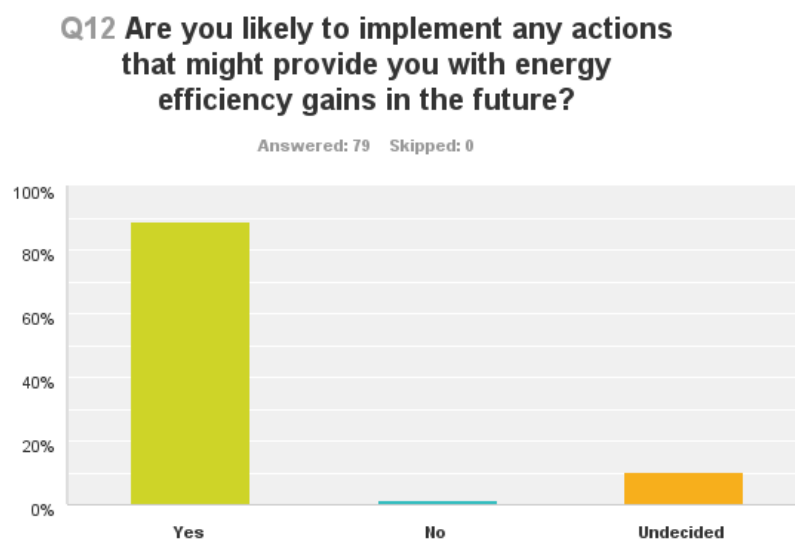


Figure 9. Participant likelihood of implementation actions after the workshop.

Q13 Do you feel confident using the presented tools independently in the future?

Answered: 79 Skipped: 0

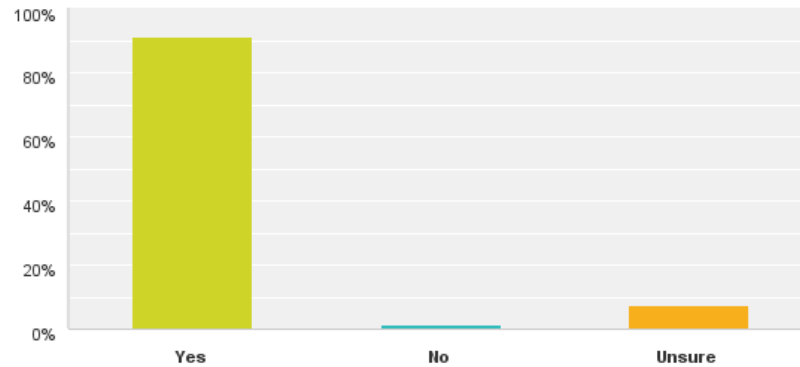
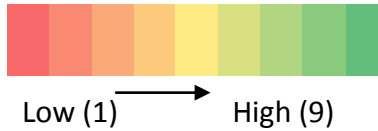


Figure 10. Participant confidence in using the tools after the workshop.

APPENDIX D. Industry Skills Development Participant Survey



COMPETENCY							AVERAGE RESPONSE
1. Using camera or phone to collect data							6.5
2. Power supply meters							6.1
3. Start pump and observe meters & gauges							6.1
4. Take photos and gps coordinates							6.1
5. Total dynamic head							5.9
6. Remove measuring equipment							5.9
7. Reading power meter							5.8
8. Calculate the TDH in theory							5.8
9. Using alternate methods to obtain data							5.7
10. Different types of pumps							5.6
11. What data can be collected before pump starts?							5.6
12. Understanding pump curves							5.6
13. Using gauges							5.6
14. Fit gauges							5.6
15. Calculate data collected							5.6
16. Field test procedures							5.5
17. Fit flow meter							5.4
18. Enter data into IPERT							5.4
19. kWh							5.3
20. Document measurements							5.2
21. Using ultrasonic flow meters							5.1
22. Pipes							5.1
23. Depth bore or well							5.1
24. Depth water, measure flow and pressure							5.1
25. IPERT program and field sheet							5.0
26. Valves							4.7
27. Understanding pipe curves							4.5
28. How would you present this information							3.6
29. Making recommendations							3.0