



# Research



*National Centre for  
Engineering in Agriculture*

Feasibility of Solar PV Irrigation in Queensland

## **REPORT 2: Solar Irrigation Incentives, Funding and Financing Opportunities and Programs**

Prepared for Queensland Government (Department of Natural Resources, Mines and Energy)

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## Executive Summary

This document is the second report in a series of three publications which discuss the feasibility of solar PV powered irrigation systems in Queensland.

These reports provide a useful resource to inform the feasibility of solar PV powered irrigation in Queensland by:

- Identifying and discussing the technology of solar power and pumping systems.
- Outlining incentive and funding opportunities for solar pumping systems.
- Reviewing Queensland agribusinesses' irrigation systems, efficiencies and crop and irrigation water requirements.

These reports do not provide a detailed address of grid connected solar PV rather focussing primarily on potential for standalone solar PV and diesel hybrid systems.

Solar irrigation must be considered in a holistic (whole of system) manner. Water demand should be seen as the critical starting point. Understanding irrigation demand is as important as understanding the technologies involved in the conversion of solar energy to electricity, to meet this demand.

When considering solar irrigation the starting point is an analysis of current energy usage. This is followed by an evaluation of energy conservation and efficiency opportunities of the current system, before finally looking at appropriate renewable energy technologies.

**Report 1** provides a technical summary of solar power and solar irrigation systems in Queensland.

**This report** describes a number of incentives, funding opportunities and programs to support uptake of solar systems. These include Renewable Energy Certificates and Feed in Tariffs (for grid connected systems). There are a range of energy efficiency loans, energy services agreements and project specific funding from agencies such as the Queensland Rural and Industry Development Authority. Businesses can also apply for finance through the Clean Energy Finance Corporation and the banking sector with reduced rates and fees, due to the renewable nature of infrastructure.

There are a wide range of Federal, State and private sector financing options for renewable energy infrastructure and farmers are not always well informed of these opportunities. Better information with links to the service providers would support adoption.

The Queensland Governments Energy Savers Plus program has been effective to audit agribusiness energy use. This program should be extended, with a stronger focus on broader issues of irrigation practice, crop water requirement and implications on energy and water use efficiency and demand management.

Finally, **Report 3** outlines a number of factors that impact the scale of and potential market opportunities for solar irrigation systems in Queensland. These factors include:

- Crop water use and irrigation requirement for different industries.
- Typical capacity of irrigation pumps.
- Pumping costs and pumping efficiency.

# 1. Introduction and Scope

On 30 November 2016, the Queensland Government, as part of its response to the Queensland Productivity Commission's Electricity Pricing Inquiry Final Report, announced the Regional Business Customer Support Package (RBSCP). As part of this package, the Government made a commitment to investigate opportunities to utilise solar PV for water pumping and irrigation.

The Department of Natural Resources, Mines and Energy (DNRME) subsequently engaged the University of Southern Queensland to undertake research into the potential for solar PV as a replacement or complementary system for diesel powered irrigation and water pumping.

USQ were commissioned to summarise existing information on and initiatives around solar pumping relevant to Queensland. A review of Queensland agribusinesses' irrigation systems, efficiencies and crop and irrigation water requirements was also to be provided.

Prior to this engagement, much work has been undertaken by others on this topic. The Queensland Government's Energy Savers Plus Program, which has now been extended under the Affordable Energy Plan (Business Energy Savers Program), has produced a number of high quality case studies and reports. The NSW Government and NSW Farmers Association have also published excellent user friendly manuals on solar PV for irrigation and separately for stock watering. These have been a key resource for the technical components of this report. NSW AgInnovators provides good resources and explains the technology and components in a solar PV system.

By agreement with the Department of Natural Resources, Mines and Energy, this project does not provide substantial detail on grid connected solar PV and has been limited to standalone and diesel hybrid systems, including battery storage.

Solar irrigation must be considered in a holistic (whole of system) manner. Water demand should be seen as the critical starting point, rather than the solar hardware perspective. Understanding irrigation demand is as important as understanding the technologies involved in the generation (or more correctly the conversion) of solar energy to electricity.

Figure 1 illustrates the flow of energy and water through an irrigated agricultural system. Consideration of water demand from crops (irrigation) and stock watering and the water source (surface or groundwater) is the starting point. The technical requirements of the solar PV system in terms of pressures and flow rates are determined by this, which will impact the hardware (panels, battery, inverter, motor and pump).

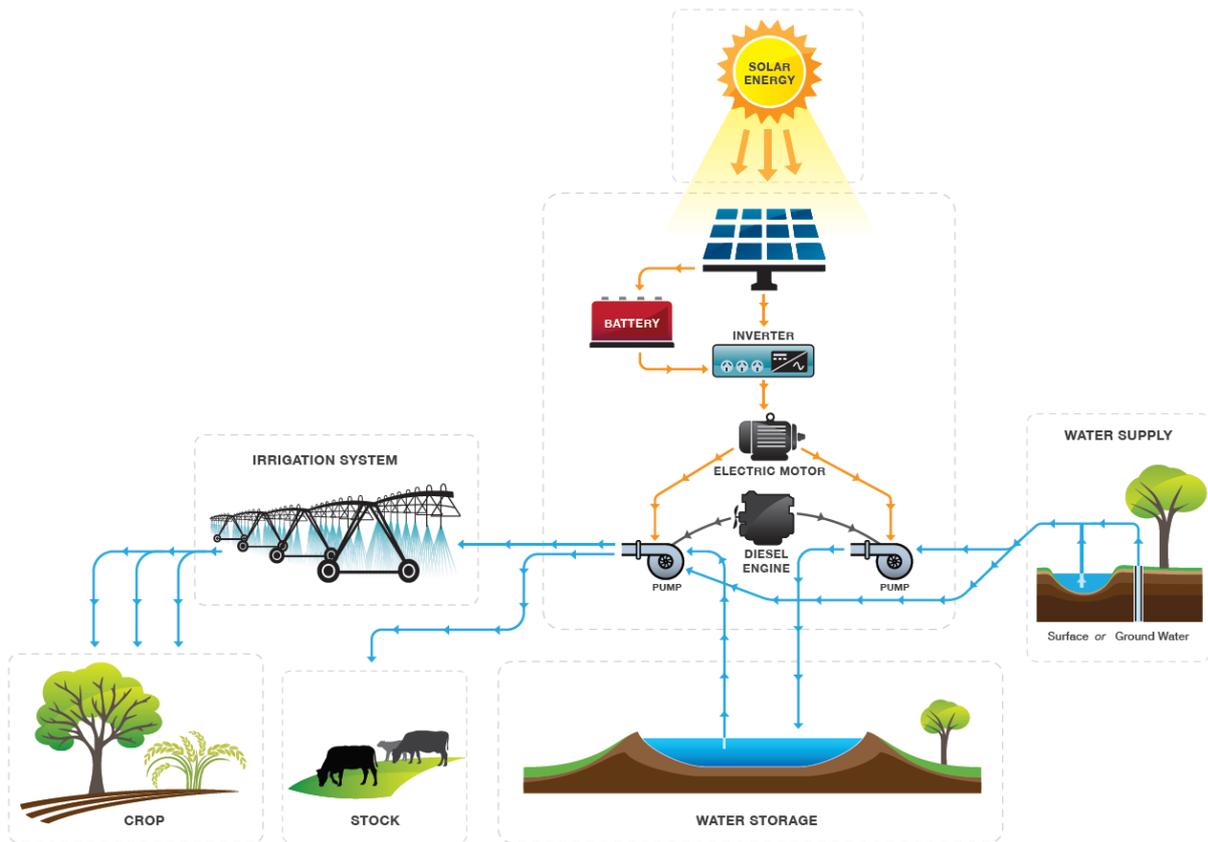


Figure 1 - Whole of system approach to solar PV water pumping

## 2. Methodology

The project methodology combined desktop assessment, and ground truthing through discussions with key stakeholders on both the supply and customer side of solar PV irrigation systems. This included:

1. Reviewing existing technical information on solar power and solar irrigation (Report 1)
2. Collating information on incentives and funding opportunities for solar pumping (this report)
3. Assessing Queensland agribusiness' pumping capacities, and irrigation and water requirements (Report 3)

For this assessment of solar irrigation incentives, funding and financing opportunities, public and private initiatives from other Australian states and territories, and key industry bodies covering solar powered pumping for irrigation have been documented. While the project focussed on non-grid connected systems some incentives for grid connected systems, such as feed in tariffs, are included to highlight opportunities for revenue generation using these systems.

## 3. Solar Irrigation Incentives, Funding and Financing Opportunities and Programs

### 3.1 Incentives

Currently there are two main incentives for the uptake of solar systems: certificates from the Federal Renewable Energy Target and state based feed in tariffs. Over the past decade each state has introduced solar programs to facilitate the uptake of solar systems, although these schemes have mainly been orientated towards residential properties.

Businesses are also able to apply for funding through equipment finance, commercial loans, energy efficient loans, energy services agreements or project specific funding from agencies such as the Queensland Rural and Industry Development Authority (QRIDA, previously QRAA). Business have in recent times also been able to apply for finance through the Clean Energy Finance Corporation (CEFC) and the banking community with reduced rates and fees, due to the renewable nature of infrastructure.

### 3.2 Renewable Energy Certificates (RECs)

Renewable Energy Certificates (REC's) is a term used to describe both small-scale technology certificates (STC's) and large-scale generation certificates (LGC's) generated under the federal Renewable Energy Target. Typically, large-scale generation certificates (LGC's) are not applicable to most irrigation sized solar systems as the qualifying condition requires installed capacity greater than 100kW in capacity with output greater than 250MWh per annum. A single REC is equivalent to one megawatt hour of renewable energy generation produced. These certificates are generated for the life of the Renewable Energy Target which runs to 2030. STC's are the appropriate REC for most Solar PV irrigation systems. STC's are currently available for qualifying solar power systems and can be traded for cash. The value of an REC is dependent on market conditions (Energy Matters 2017).

The number STC's generated by a system is calculated based on a given location and size of solar installation. Prices of STC's can range from \$30-\$40 but are market dependant; so can fluctuate. As of late 2017 STC's were trading at \$35 - \$36 (Trade In Green 2017).

The value of the STC's are typically built into the installers quote or package pricing, the installer administrates the redemption and trading of the certificates, leaving the customer to only pay the net amount. The entitlement for STC's can be found on the Australian clean energy regulator's webpage (<https://www.rec-registry.gov.au/rec-registry/app/calculators/sgu-stc-calculator>).

### 3.3 Feed-in Tariffs

If the solar PV system is connected to the state network, excess electricity can potentially be sold into the electricity grid. The amount of electricity that can be exported is dependent on the connection agreement in place with the relevant electricity distribution business (Ergon in regional Queensland and Energex in South East Queensland).

Within Regional Queensland the feed in tariff for systems up to 30kW in capacity is determined annually by the Queensland Competition Authority and is currently approximately 10c/kWh. Within South East Queensland the retail market is more competitive and retailers offer a range of electricity products with varying feed in tariff rates. The Queensland Competition Authority annually monitor and report on feed in tariff offers. It is important to consider your overall electricity consumption when comparing market offers.

### 3.4 Energy Efficiency Loans

Queensland Farmers Federation (QFF) (2017a) have outlined below the mechanisms and operation of Energy Efficiency Loans, Energy Services Agreements and Solar Power Purchasing Agreement; they also outline several advantages and disadvantages for the three services.

Energy Efficiency Loans (EEL) are becoming more widely available in the marketplace. These loan products are tailored to overcome barriers to energy efficiency implementation. In practice Energy Efficiency Loans are similar to equipment financing with preferable rates or longer loan periods.

Advantages:

- Reduced upfront costs for the project
- Interest charges can have tax advantages
- Repayments are generally fixed and known in advance
- Loans may be secured against the equipment
- Finance is potentially at a discount to market rate and loan periods can be longer than otherwise offered.

Disadvantages:

- Interest rates for loans secured against the equipment are generally higher than mortgage interest rates
- There is a limited number of firms offering these products.

Figure 2 shows the various options available from CEFC, QRIDA (formerly QRAA) and other private financiers, it explains how each type of funding is structured, their benefits and other relevant information.

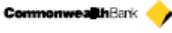
	Energy Efficiency Loans				Energy Services Model
	Clean Energy Finance Corporation Co-Financing Partnerships	CEFC CLEAN ENERGY FINANCE COOP	QRAA	Private Financiers	
Program name	 <b>Equipment Finance Energy Efficient Bonus</b>	 <b>Energy Efficient Equipment Finance</b>	 <b>Energy Efficient Finance</b>	<b>QRAA Sustainability Loan – Primary Producer</b>	<b>Energy Services Agreement or "Turnkey Solutions"</b>
Description	...Simply apply for an Equipment Loan, Hire Purchase or Finance Lease from NAB – if the equipment meets CEFC criteria for energy efficiency, 0.70% will be deducted from the finance rate...	...Partnering with the Clean Energy Finance Corporation, the CBA provides discounted financing to help businesses fund energy efficient vehicles, equipment and projects...	...Westpac is helping Australian businesses reduce their energy costs and environmental footprint by providing financial solutions for energy efficient equipment...	Sustainability Loans provide you with up to \$1.3M to cover capital costs to achieve a more productive and sustainable primary production enterprise.	An Energy Services Company may design, install, commission, finance and maintain new energy efficient or renewable energy equipment, with service charges designed to be less than energy savings.
Benefit	Bonus 0.70% p.a. off your equipment finance rate, on qualifying assets for the life of the financing.	0.70% discount off standard asset finance rates.	You may be entitled to 0.70% p.a. discount on the interest rate when you purchase certain equipment.	Low interest rate fixed for 1, 3 or 5 years (Interest rates are subject to change in January and July each year).	Generally no up-front costs (Some providers prefer a partnership where the site makes a small up-front contribution of 15-20%), and asset is transferred to the land owner after agreed payback.
Conditions	For energy efficient, renewables and low emissions technologies that meet CEFC criteria.	For energy efficient, renewables and low emissions technologies that meet CEFC criteria.	For energy efficient, renewables and low emissions technologies that meet CEFC criteria.	If you meet QRAA's eligibility requirements.	Energy efficient equipment and renewables. Some providers have backing to finance certain products such as solar PV generation.
Range min-max (\$)	< \$5.0m	Minimum \$10k-\$5.0m	Minimum \$15k-\$5.0m	\$0-\$1.3m	Depending on provider. Generally above \$50,000, but some start at \$5,000.
Security: secured on...	Typically the equipment, however could include other security NAB considers necessary.	Typically the equipment, however could include other security CBA considers necessary.	Typically, Westpac will require security over the equipment.	Satisfactory to QRAA with a value commensurate with the loan amount; this may include land, equipment or any other security QRAA considers appropriate.	Unsecured or secured on the equipment. Equipment may be owned by Service Company until completion of agreement.
Application process	Via NAB: <a href="http://www.nab.com.au/eeb">www.nab.com.au/eeb</a>	Via CBA: <a href="https://www.commbank.com.au/business/asset-finance/energy-efficient-loan.html">https://www.commbank.com.au/business/asset-finance/energy-efficient-loan.html</a>	Via Westpac: <a href="http://www.westpac.com.au/energy">www.westpac.com.au/energy</a>	Via QRAA – <a href="http://www.qraa.qld.gov.au/current-programs/Productivity-Loans/Sustainability-Loan-Sustainability-Loan-Primary-producer">www.qraa.qld.gov.au/current-programs/Productivity-Loans/Sustainability-Loan-Sustainability-Loan-Primary-producer</a>	Direct to Providers such as: • Northquest • Websters Group • Verdia
Contract period	< 10 years	< 10 years	< 10 years	< 20 years	< Generally 3-10 years depending on energy savings.
Up-front payments	Typically \$0 deposit, or as otherwise advised by NAB.	As advised by CBA.	As advised by Westpac.	No upfront payments or costs.	Not required by all providers.
Setup costs	As advised by NAB.	As advised by CBA.	As advised by Westpac.	\$0	\$0 (documentation fees may apply)
Statutory costs	As advised by NAB.	As advised by CBA.	As advised by Westpac.	\$0	\$0
Equipment performance	With equipment vendor and warranty. Not related to financial arrangements.	With equipment vendor and warranty. Not related to financial arrangements.	Please speak to the vendor or energy consultant you used to procure your energy equipment. Generally not related to financial arrangements.	With equipment vendor and warranty. Not related to financial arrangements.	Some Energy Services Companies will take Performance risk.
Warranty and maintenance	Generally with the borrower.	Generally with the borrower.	Generally with the borrower.	Generally with the borrower.	Some Energy Services Companies will maintain and warrant until the asset is transferred. Maintenance costs covered in the Service Agreement.

Figure 2 Financing Options (Queensland Farmers Federation 2017a).

### 3.5 Energy Services Agreements

Through an energy service agreement (ESA) a provider will design, install, operate and hold ownership of equipment (e.g. solar panels, inverters, etc)

installed at the customers premises. The customer is charged an agreed usage fee, which covers operation, maintenance, energy costs and a fee to recoup installation costs. The customer can typically purchase equipment at the end of the agreed term. The fees are calculated using various indices such as CPI and award rates. This provides a type of user pays mechanism for introducing renewables to the business.

Advantages:

- No or reduced up-front cost
- Some providers might offer Type 1 energy audits up front to identify potential projects
- ESA's can be off balance sheet
- Payments can be tax deductible (operating expense)
- Implementation and operating risks are transferred to the ESA provider
- The ESA provider is incentivised to maximise energy savings. They guarantee savings or the customer only pays for the output of the equipment

Disadvantages:

- Can be a higher cost than using other finance options in isolation, due to transfer of risks to ESA provider and to cover implementation and financing costs.

### 3.6 Solar Power Purchase Agreement (SPPA)

A SPPA is similar to an ESA where a provider installs, operates and owns the solar system on the property. Where the SPPA differs is that the provider will sell the customer the electricity only at an agreed rate with annual indexing. The provider is responsible for operating and maintaining the solar array (Queensland Farmers Federation 2017b). Generally, all power produced by the solar system is charged to the customer, therefore it is important that these systems be sized correctly. An oversized system could result in a customer paying more for the energy than the amount they receive for any exported power.

Advantages:

- No capital cost for the project.
- An agreed energy price for all the power generated for the life of the contract for the power generated from the solar PV system.
- The provider is responsible for maintenance and performance.

Disadvantages:

- May not suit strongly seasonal businesses.
- Customer receives two invoices – one from your current retailer for grid electricity and network charges, and one from the Solar PPA Provider.

- Minimum contract periods may apply.
- Not suitable for those systems that operate off-grid
- There may be extra costs and exit fees

### 3.7 Energy Savers Program

Ergon Energy and Queensland Farmers Federation have partnered to provide the Energy Savers Program. The program aims to help farmers reduce energy cost, increase water use efficiency and provide information to farmers in the form of tools. This program has recently been extended under the Queensland Government's Affordable Energy Plan, Business Energy Savers Program.

The existing phases of the Energy Savers program is split into two different stages within Queensland, across farms in Ergon's and Energex's regions:

- Irrigators Energy Savers Program 2013 – 2015: 30 irrigation audits were conducted on a range of different farms and irrigation types.
- Energy Savers Plus Program 2015 – 2017: Up to 100 audits were conducted across a range of irrigation and on-farm processing systems in a number of sectors.

Once the audits have been completed farmers are provided with recommendations and strategies to increase efficiency on farm. Case studies are then provided to industry which showcase the benefits of the strategies (Ergon Energy 2017).

This program now includes a 3 year extension where 200 additional audits for agricultural customers will be completed. In addition to this, co-contribution grants of up to \$20,000 will be made available to assist businesses in implementing the recommendations from the audit.

### 3.8 Energy Efficiency Information Grants

#### Energy Efficiency Gains for Australian Irrigators

The Burdekin Bowen Integrated Floodplain Management Advisory Committee were funded to develop and demonstrate a process for Australian irrigators to build their capacity to overcome the low adoption of energy efficiency methodologies/technologies. The project delivered factual and practical information for energy efficiency gains. Project activities will include high-level on-farm assessments in demonstration areas, benchmarking exercises and case study development (BBIFMAC 2014).

#### Improving Energy Efficiency on Irrigated Australian Cotton Farms

The Cotton Research and Development Corporation were funded to improve energy efficiency on irrigated Australian cotton farms and reduce their energy

costs through a cost-effective process to assess and improve energy use. Energy audit research indicates that a 30% savings of energy on irrigated cotton farms is achievable. The project was designed to inform the cotton farmers how best to optimise their energy use, identify and implement appropriate energy-efficient farming practises. Delivery methods included industry-specific training, energy audits, benchmarking exercises, case studies and factsheets (Sandell et al. 2015).

### Farm Energy Innovation Program

The NSW Farmers' "Farm Energy Innovation Program" provided a comprehensive suite of services and extension materials to farmers across all sectors of agriculture (AgInnovators 2017). Much of the information provided in the reports completed are transferrable to farms in Queensland.

## 3.9 Clean Energy Finance Corporation (CEFC)

### Clean Energy Innovation Fund (CEIF)

The CEIF was developed to support the use and encourage growth in the clean energy sector. The fund set out to finance more mature technologies that have not made it to the commercially viable stage where private funding can be secured. The funding provides financial backing for businesses or projects that are based on, or around renewable technologies, energy efficiency and low emission technology. Clean Energy Innovation Fund investments have committed over \$25 million in the past 2 years (Clean Energy Finance Corporation 2017).

## 3.10 Australian Renewable Energy Agency (ARENA)

Focused on research and development, ARENA supports new and emerging technologies by working with companies to be in the forefront of renewable energy. ARENA has secured significant funding to develop projects through to the year 2022 (Australian Government 2017a).

### Advancing renewables

Supports more mature technologies that are capable of providing affordable and reliable energy based on renewables. Its focus is on reducing costs, improving technology, the removal of barriers to uptake, increasing information and knowledge on renewables. Funding is secured through competitive rounds and must align with the main focus (Australian Government 2017b).

### Venture capital fund (REVC)

Designed to foster skills and develop management potential, REVC invests in ground floor renewable companies to progress the technology where financial issues could hinder development. Access to part of the \$120 million funding are through ARENA (Australian Government 2017c).

### 3.11 Queensland Rural and Industry Development Authority (QRIDA)

Through the assistance programs it administers, QRIDA contributes to Queensland Government objectives by:

- fostering the development of a more productive and sustainable rural and regional sector in Queensland,
- supporting the state's economy by providing assistance to primary producers, small businesses and other elements of the state's economy,
- providing assistance by administering programs for the Australian Government and other states in rural and regional sectors outside Queensland (Queensland Government 2017).

## 4. Conclusions

There are a wide range of Federal, State and private sector financing options for renewable energy infrastructure. There is limited opportunity for government to provide additional support in this area. These are complex and dynamic programs and irrigators are not always well informed on these opportunities. It is important to assess current incentive programs in terms of system economic impact.

Economics is the key driver and a better understanding of the impact of financial incentives is key to an accurate economic assessment. Links to updated information on government policies and financial incentives, and ready reckoners to support robust financial analysis, would assist customers in undertaking more accurate economic assessments.

The Queensland Government's Energy Savers Plus program was effective to audit energy use. This program has been extended through the Queensland Government's Affordable Energy Plan, Business Energy Savers Program, which includes on farm energy audits. The first step in considering renewables is an energy analysis or audit of the pump station, to assess the existing efficiency of the diesel pump and motor. This should be part of a broader assessment of how the pump system is integrated into farm irrigation practice, to meet varying seasonal crop water requirement.

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