THE FUNDING OPTIONS FOR INNOVATIVE ENERGY IN SUGARCANE IRRIGATION

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Queensland Government

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Executive summary

This paper examines the funding options for energy innovation in Australian irrigated sugarcane. Implementing the latest commercially-demonstrated technologies can lead to innovative solutions in itself, as a result of farmers (constantly) testing, learning and adapting to changing circumstances. Finance has an important role in the practical applications of delivering change and productivity.

Investment in the energy sector is led by; escalating electricity prices, increased efficiency of equipment, environmental objectives and Government policies providing incentives for uptake of renewables. Once a consumer is satisfied with an investment case, several different approaches to capital management are available; cash, bank loan off balance sheet or equipment finance, rentals and through a Power Purchase Agreement (PPA). Each option shares risk between financier and consumer with various combinations of operational responsibilities.

When selecting a funding type, the 'least cost' option may not necessarily be the most suitable. Tax deductions, appetite for risk and internal capital management are all key considerations when determining the best funding alternative for an individual business.

Cash and traditional bank loans
These two options result in the outlay of up-front capital and incur a negative cash flow until the break-even point when the benefits outweigh system costs. Lending off the balance sheet has the bonus of being eligible for a 0.7% subsidy under the Clean Energy Finance Corporation for the term of the loan. These options typically give the highest economic returns, due to the lowest interest rates.

Rentals (may also be termed as leases)
An economical option for the lessees if the combination of monthly leasing fees and costs of grid consumption are lower than the 'business as usual' costs (if all electricity demands were being met completely by the grid). Rental payments often include operation and maintenance costs (O&M) associated with upkeep of the system.

The interest rate on rentals will be higher than a traditional bank loan, however, no upfront capital is required. Lump sum rental payments are generally tax deductible, where balance sheet loan repayments require more complex analysis for taxation (depreciation, interest etc.).

Power Purchase Agreements (PPAs)
A provider installs, owns and maintains a renewable system on the customers property. This option includes an agreed rate for energy supply in c/kWh for a fixed term. The PPA provider takes all equipment and output risk while the consumer enjoys a rate below market and no capital outlay. The margin between retail (business as usual) and PPA rate plays a large role in long-term benefits accrued under this option. There may be options for ownership of the system at the end of the contract. This option is contractually the most complicated.

This study uses two case study sites to compare the various funding options. The case study examples are a 22 kW pump used for flood irrigation in the Burdekin and a 55 kW pump used for drip irrigation on the Tablelands. Each scenario is analysed using Net Present Value and breakeven analysis.

Farming businesses are encouraged to use a trusted financial advisor to carefully assess project feasibility prior to considering renewable energy finance options. As with all contracts, the devil is in the detail, a financial advisor can also assist in navigating the pros and cons of each finance option.

INTRODUCTION TO FINANCE AND ENERGY

1. Introduction to finance and energy

Efficient and effective financial markets play a central role in driving economic growth through their ability to spur technological innovation and adaptation. As the world increasingly becomes more electrified and our energy intensity increases, financial markets play a major role in making energy innovation accessible.

Capital markets in Australia are traditionally conservative with regards to appetite for risk. Until relatively recently, the application of innovative energy technologies has largely been undertaken by early adopters often with government support or by organisations with external drivers such as sustainability goals.

According to the International Energy Agency, a cumulative US$44 trillion in investment is needed in global energy supply to meet climate agreements and global energy demand: 60% of which goes to oil, gas and coal extraction and supply, including power plants using these fuels, and nearly 20% to renewable energies. An extra $23 trillion is required for improvements in energy efficiency.[1]

Capital markets are mobilising to tackle the enormity of this task. Along with the growing appetite for exposure to these markets, funding mechanisms are maturing. This means that innovation in energy technologies is now available to more consumers than ever before. Financing being widely available and affordable can also drive adoption for the non-incentivized market.

Investment in power generation globally has dramatically shifted away from fossil fuels and is heavily focused on renewable energy. Renewables are beating fossil fuels 2 to 1 in new generation. More new renewable power was installed in 2015 than fossil fuels and this trend continues. This makes renewable energy the biggest growth area in the energy industry. Figure 1 shows the investment in new generation globally by energy source.

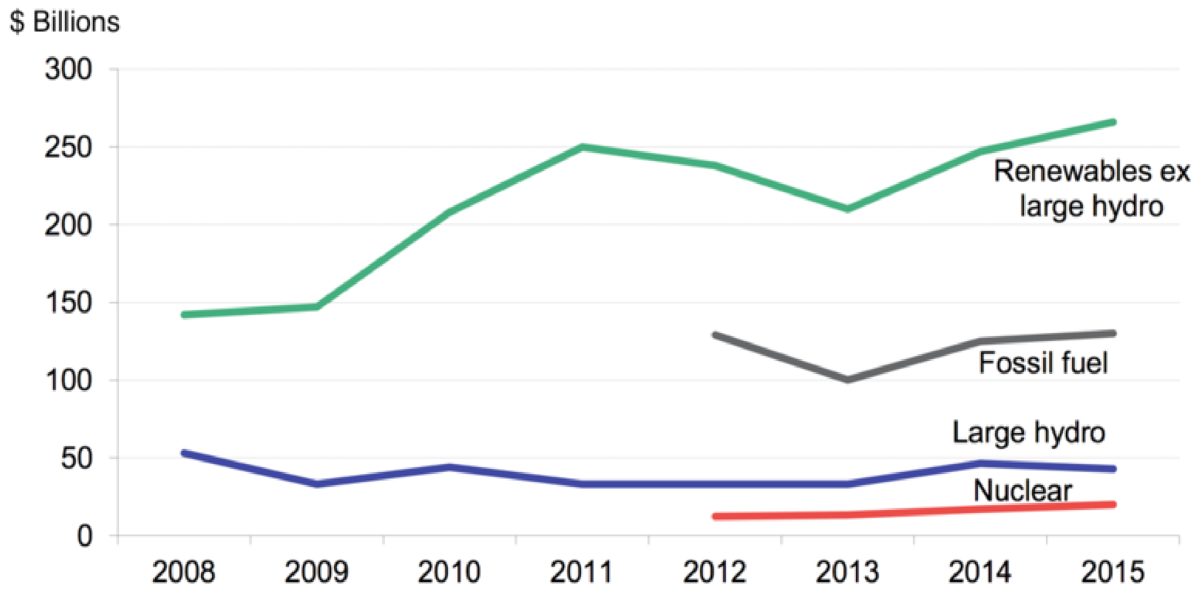

Figure 1: New investment in Power Capacity, 2008-2015 Source: BNEF, UNEP

[1] IEA, World Energy Outlook 2016 - http://www.iea.org/Textbase/npsum/WEO2016SUM.pdf

REGULATORY LANDSCAPE

2. Regulatory landscape

Both Federal and State based renewable energy targets and policies create varied incentives for investment in renewable energy.

Renewable Energy Target

The Renewable Energy Target (*RET*) is a Federal Government scheme designed to increase the share of electricity generated in Australia that is provided by renewable sources. The overall intention being to reduce the emissions of greenhouse gases from electricity generation and to promote the development of a renewable energy industry in Australia.

The 'target' of the scheme is to generate an additional 20 per cent of electricity from renewable sources by 2020, compared with 1997 levels. The RET is practically implemented through a mechanism of creating and trading renewable energy certificates.

Originally known as the Mandatory Renewable Energy Target or MRET, the RET has been the only consistent mechanism of Australian Federal Government climate change adaptation policy. It has been altered but remains in place since its implementation in 2001 under the Howard Government.

How does the RET work?

The RET is designed to create a demand for electricity generated from renewable sources. Electricity retailers and large energy users, known as *liable entities* are obliged to purchase a specified percentage of their electricity from renewable sources each year.

The RET is split into two separate targets: the large-scale RET (or LRET), for large renewable electricity developments like wind and solar farms, and the small-scale renewable energy scheme (the SRES) for small technology installations like rooftop solar and agricultural applications under 100 kW.

The ***Large-scale Renewable Energy Target (LRET)*** requires high-energy users to acquire a fixed proportion of their electricity from renewable sources. This occurs in the form of large-scale generation certificates (LGCs), which are created by large renewable energy power stations (such as solar or wind farms) and then sold to high-energy users who must surrender them to meet their obligations under the LRET. Solar over 100kW fall into the LRET, which requires more administration than the SRES.

The ***Small-scale Renewable Energy Scheme (SRES)*** provides a financial incentive for individuals and businesses to install small-scale renewable energy systems such as rooftop solar, solar water heaters and heat pumps. This occurs in the form of small-scale technology certificates (STCs), which are issued up front for a system's expected power generation (based on its installation date and geographical location) until the SRES expires in 2030. Similar to the LRET, large energy users are required to purchase a fixed proportion of STCs and surrender them to meet their obligations under the RET. Most installations for sugarcane irrigation are likely to fall into the SRES.

How will the RET look going forward?

LRET

While the LRET's 33,000 Gigawatt hours (GWh) target is expected to be met before the 2020 deadline, the scheme will continue to require high-energy users to meet their obligations under the policy until 2030.

As more renewable energy is produced beyond the 33,000 GWh target, the number of LGCs generated will continue to increase, leading to an oversupply in the market that will significantly reduce their value. Futures markets indicate that LGC prices will fall significantly over the next ten years, with some analysts predicting that their value will fall to zero by the time the RET expires in 2030, with many expecting that to occur much sooner.

SRES

The SRES is scheduled to run until 2030, with the level of subsidy available falling each year between now and the end of the scheme. There is no limit on the amount of renewable energy that can be produced under the SRES. However, a July 2018 report by the Australian Competition and Consumer Commission into electricity prices recommended that the SRES be abolished in 2021 rather than 2030 to reduce electricity costs.

The solar industry is regulated through an accreditation scheme that is linked to the SRES through legislation. The accreditation scheme has been instrumental in maintaining high safety and quality standards during a decade of massive growth.

The SRES incentives will wind down each year in January, with the deeming period for renewable energy credits reducing annually. STCs make a valuable contribution to the installation feasibility when incorporating renewables into farm-scale generation[2]. Figure 2 shows around a $6,000 reduction in credits per year based on $38/STCs on a standard 100 kW PV system.

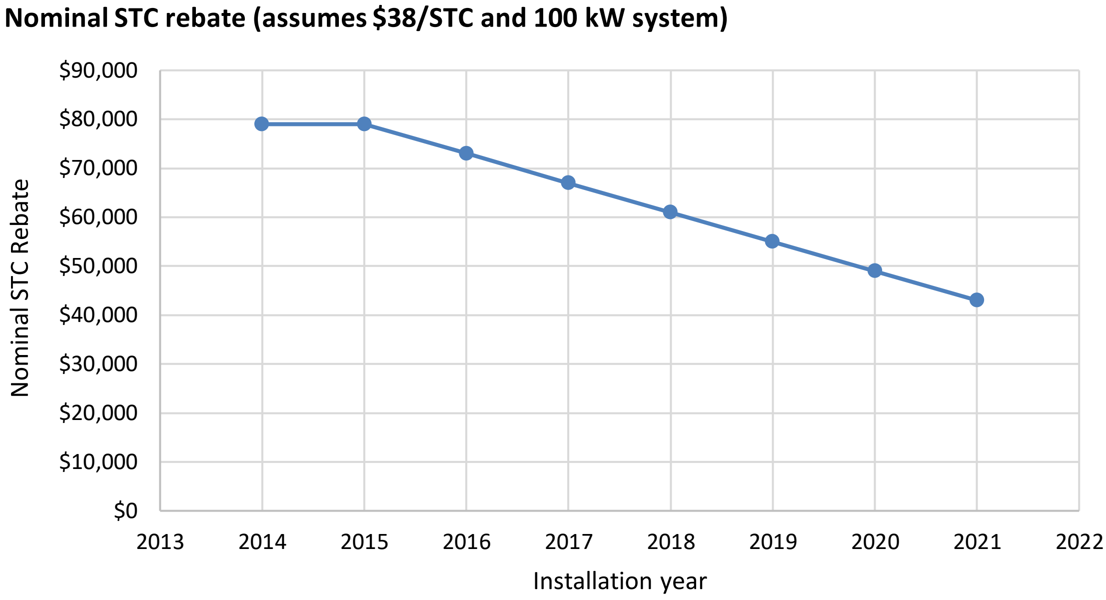

Figure 2: Nominal STC rebate assuming a 100 kW solar PV system installed Mackay, QLD ($38/STC).

Clean Energy Finance Corporation

The role of the Clean Energy Finance Corporation (*CEFC*) is well described by the most recent *Clean Energy Finance Corporation Investment Mandate Direction 2018* as, "a mechanism to help mobilise investment in renewable energy, low-emissions and energy efficiency projects and technologies in Australia, as well as manufacturing businesses and services that produce the required inputs."

Established to finance Australia's clean energy sector using financial products and structures to address the barriers inhibiting investment, the CEFC has played an important role in the capital markets of the sector. It invests at the demonstration, commercialisation and deployment stages of innovation and applies commercial rigour when making investment decisions. This means it does not fund fairy tales rather it seeks to provide capital to commercial projects that need a lead investor. This leadership is usually reserved and limited to co-investment to stimulate action.

Seeded with $10 billion over five years, it targets an average return of the five–year Australian Government bond rate +3 to +4 per cent per annum over the medium to long term as the benchmark

[2] SRA Energy Webinar 2018 https://www.youtube.com/watch?v=rQw-KxJRVzg&t=163s

return of the whole portfolio (measured before operating expenses). That target return range is lower than the targets of a standard superannuation fund or fund manager. This along with being before expenses, means that the CEFC sits in a risk bracket just lower than where the market sits. Basically it is trying to stimulate investment without exposing itself to unnecessary risk.

The CEFC has aimed to be a catalyst for financing energy innovation. Many financial instruments and facilities were well advanced but the CEFC has aimed to accelerate the growth and maturity of these products. In some cases its role has reduced the cost of capital and increased the accessibility of it across the market. Usually requiring co-investment has meant the $10 billion seed funding has catalysed investment of $19 billion. Those irrigators who bank with ANZ, NAB, CBA or Westpac can apply for a discount of 0.7% for asset or equipment finance on energy efficiency improvements or installations under CEFC[3] incentives for agribusiness.

The Australian Labor Party intends to double the funds available to CEFC if it wins the 2019 Federal Election.

Queensland Government low-interest loans

The Queensland Rural and Industry Development Authority (QRIDA) offers a Sustainability Loan for Primary Producers with up to $1,300,000 available to assist with achieving more productive and sustainable practices. Upgrading irrigation plant to improve productivity via alternative energy systems falls within the scheme's criteria. The loan term is up to 20 years at a 'base loan rate', which may change through the course of the term loan. For more information and to access the full terms and conditions visit http://www.qrida.qld.gov.au/current-programs/Productivity-Loans/sustainability-loan/Sustainability-Loan-Primary-producer

The Australian renewable energy race

The Climate Council's 2018 renewable energy scorecard (Figure 3) found Tasmania, the Australian Capital Territory (ACT) and South Australia were leading the other states and territories across a range of renewable energy measures – based on each state's proportion of renewable energy, wind and solar capacity per capita, proportion of households with solar, and renewable energy targets and policies. Figure 3 shows which states are leading the way on renewable energy investment.

Queensland and Victoria have ambitious renewable energy targets and policies to increase the amount of renewable energy such as mandatory Feed-in Tariffs (FiTs) and Time-of-Use (TOU) FiTs to encourage battery storage and PV installs where the local network may be supply constrained. In regional Queensland, Ergon only permits FiTs to a cap of 30 kW of export. Embedded generation exceeding 39 kW solar PV requires 'user pays' network studies. FiT rates are determined by the regulator and can change from year to year.

[3] http://www.agriculture.gov.au/SiteCollectionDocuments/ag-food/cefc-factsheet-clean-energy-for-agribusiness.pdf

THE AUSTRALIAN RENEWABLE ENERGY RACE:

2018 SCORE CARD

	% Renewable energy (2017)	Capacity per cap (kw/cap)	% solar households	Renewable energy targets	Net zero emissions targets	Highlights
TAS (A)	87.4	0.7	14	100% by 2022	Net zero by 2050	Highest proportion of renewable electricity. Achieved net zero emissions.
ACT (A)	46.2	1.1	14	100% by 2020	Net zero by 2045	On track to meet renewable energy target.
SA (A)	43.4	1.1	32	-	Net zero by 2050	On track for 73% renewables by 2020.
VIC (B)	13.6	0.3	16	25% by 2020 40% by 2025	Net zero by 2050	Completed Australia's largest renewable energy reverse auction.
QLD (B)	7.1	0.1	33	50% by 2030	Net zero by 2050	Highest proportion of solar households. Largest number of projects under construction.
NSW (C)	12.6	0.2	18	-	Net zero by 2050	Strong pipeline of renewable energy projects with planning approval.
NT (C)	3.0	0.1	14	50% by 2030	-	50% renewable energy target by 2030.
WA (C)	7.5	0.2	27	-	-	Only state with no renewable energy target or net zero emissions target.

CLIMATECOUNCIL.ORG.AU   crowd-funded science information

Figure 3: The Australian Renewable Energy Race, 2018 Score card. Source: Climate Council 2018, https://www.climatecouncil.org.au/resources/states-renewable-energy/

BUILDING AN INVESTMENT CASE

3. Building an Investment Case

Capital budgeting involves evaluating an investment decision from the perspective of the investor. It is the process of allocating resources for significant investments while taking into consideration the investor's capital structure.

The key questions an investor asks being, firstly, "should we go ahead with this investment?" and, secondly, "if so, how should we fund it?"

One of the primary goals of capital budgeting investments is to increase the value of the business. Other considerations include;

- Tangible and intangible benefits
- Reputational
- Sustainability
- Conscious capital
- Financial analysis

The investment case for renewable energy in Australian sugarcane irrigation has been made by SRA funded analysis [4][5] and Queensland Farmers' Federation – Energy Savers program[6].

There are a several methods commonly used in the evaluation of energy projects. The below methods (discussed in detail in Appendix 1) include;

- Simple payback period
- Net present value (NPV)
- Internal rate of return (IRR)
- Levelized Cost of Energy (LCOE)

These methods are also those used in the case study analysis in section 5 of this report. When comparing funding options, it is useful to use a combination of analytic methods.

[4] Welsh J.M. and Powell J.W. (2017). "Opportunities for energy innovation in Australian irrigated sugarcane". SRA report. Ag Econ, Australia. Found online at https://sugarresearch.com.au/wp-content/uploads/2018/01/Energy-in-irrigated-cane_2017x.pdf

[5] Ag Econ fact sheet, "Integrating alternative energy solutions: irrigated cane", found online at https://www.agecon.com.au/media-publications-1

[6] QFF Energy Savers program case studies found online at https://www.qff.org.au/projects/energy-savers/

FINANCE OPTIONS

4. Finance options

The availability of finance for energy efficiency and renewable energy projects has increased in recent years. There are a range of finance options and providers for commercial businesses.

The following section provides an overview of the current energy efficiency and renewables finance options available in Australia, including the advantages and disadvantages of each. The broad terms offered by financiers for each option are outlined, as well as the suitability of each option to different businesses and technology types.

- Cash
- Bank borrowing chattel mortgage (traditional lines of credit) or equipment finance
- Rental (or lease)
- Power purchase agreement (PPA)

Cash

The first financing option considered is using existing cash funds.

Table 1: Advantages and disadvantages of funding with cash

Option	Description	Advantages	Disadvantages
Cash	Project is financed with owner's funds from the capital budget.	No external obligations to financiers. Business owns and can depreciate the equipment. In terms of solar, lowest cost for energy production (LOCE)	Must meet the company's minimum acceptable rate of return on capital (also referred to as the project hurdle rate). Opportunity cost from less capital being available to invest in core business activities. Business carries all finance and performance risks.

Figure 4 shows a cash purchase whereby the installation is in arears until between years 3-4, at this point the savings achieved have paid for the equipment purchase.

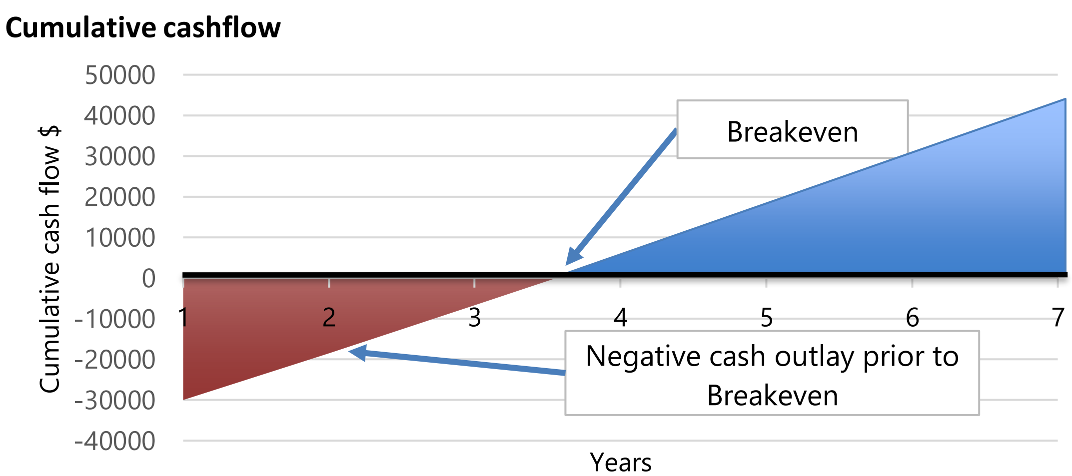

Figure 4: A cash purchase will incur a negative cash flow until the savings outweigh the equipment cost between years 3 and 4.

Finance – buy now, save and pay later

A common mistake made in any procurement process is to purchase what appears to be the cheapest option upfront and be saddled with higher operating costs over the life of the project.

A more efficient piece of equipment may have significantly lower operating costs but may be more expensive upfront - renewable energy and energy efficiency investments are a prime example.

If the business does not have the cash upfront to fund an investment in energy innovation, then how can it benefit? Finance can overcome this problem and others posed below.

- What if the business does not have the cash?
- What if the business just wants lower electricity bills without spending any amounts upfront?
- What if the business focuses on the first 4 years of negative net cash?

> *Finance can help renewables be viewed by commercial customers as an electricity bill reduction without capital commitment*

Types of commercial solar finance

In this guide we analyse three key sources of commercial solar finance that work for sugar industry participants:

- Traditional bank loans and Finance Leases
- Rentals
- Power purchase agreements (PPAs)

Each product has its advantages and disadvantages, so it is important to understand the circumstances of the specific operation to make good choices. Some general considerations that should be made are outlined below.

General Considerations

Access to finance is a primary consideration. The size of the installation, the size of the farming operation and the relationship with the existing bank are all important when weighing up whether to use a farm's own cash versus a funding solution.

Additionally, how the treatment of finance is realised for the farm should be considered with particular reference to the **balance sheet**. Will an operating expense work better for the farm or will capital expenses work better?

Operating expenses are expenses incurred during regular business, such as general and administrative expenses and the cost of goods sold. You can generally claim a tax deduction for most operating expenses in the same income year you incur them.

Capital expenses are incurred when a business spends money, uses collateral or takes on debt to either buy a new asset or add to the value of an existing asset. Examples of capital expenses include the purchase of fixed assets, such as new buildings or business equipment (i.e solar panels to power irrigation motors) and upgrades to existing facilities.

Each financing products are treated differently from the customer's perspective and need careful consideration. If equipment is leased instead of purchased, it is typically considered an operating expense. The key considerations in finance structures in broad terms are summarised in Table 2.

Table 2: Key considerations under various forms of finance

Up-front commitment of capital	Depending on projected cash flow, it may be advantageous for some businesses to consider finance options with little or no up-front capital
Ownership of the asset and balance sheet impact	There are benefits to avoiding having new debt on the balance sheet as this can affect existing loan covenants and the ability to get further finance. However, some businesses may prefer to own assets, even if this impacts their balance sheets
Security / collateral	Some finance options require that a business or its owners provide security or supporting collateral, which can be a barrier
Repayment terms	Businesses should be wary of repayment obligations which they might be unable to meet, especially when repayments vary
Tax treatment	Depreciation, interest payments and repayments that are treated as operating costs are tax deductable
Risk transfer	The risk of the energy efficiency or renewables project not performing as expected or losing value to the financier can be transferred under some finance options.

Source: Energy Efficiency and Renewables Finance Guide, 2014, NSW Office of Environment and Heritage.

Loans and finance leases

Under a commercial loan or finance lease, a Bank or Finance Co lends money to the customer who purchases the solar system. There are many good value options available in the market and they are widely accessible, without the need for relationship banking.

- Typical terms are from five to seven years.
- Solar equipment can be depreciated by the owner of the equipment (accelerated if below a threshold) but the long effective life limits impact.
- Interest component of repayments are tax deductible.
- Interest Rates and risk appetite are both customer dependent.
- Likely to be the lowest interest rate of all finance options.

Figure 5 illustrates the cash flow for a bank loan where the comparative self-funded with cash net savings (red line) commences at -$52,500 and the loan repayments (blue line) are met at year five. In this instance the net of finance (yellow line) experiences an increase until the inverter is changed in year 10 denoted by the slight dip in annual cash flow.

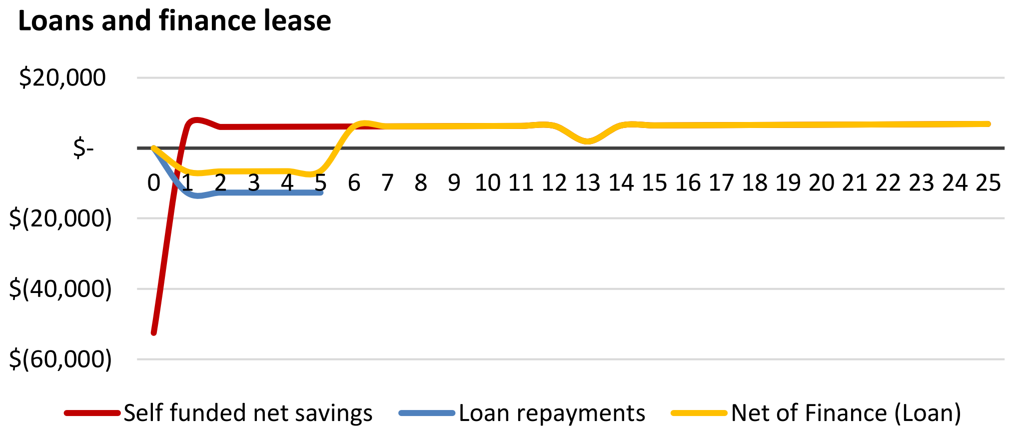

Figure 5: Loan option cash flow comparison

A summary of the advantages and disadvantages of a commercial loan is shown in Table 3.

Table 3: Pros and cons of a commercial loan

Option	Description	Advantages	Disadvantages
Commercial loan	A lender provides capital to a borrower, to be repaid by a certain date, typically at a predetermined interest rate that moves in line with changes in a reference lending rate. Customer makes regular repayments to lender to cover interest costs. Capital repayments can be bundled with interest payments, or can occur at the end of the loan.	Reduced up-front capital requirements. Interest and depreciation of energy efficient equipment are tax deductable.	Customer bears the economic and technical risk if the equipment becomes unusable. Customer could be required to provide security, such as a lien on property or other assets, or guarantees from parent companies, another financier or owners. Loan is on the balance sheet.

Rentals

Rental agreements appear similar to finance leases or loans although there are important differences. Under a rental, the Finance Co makes the purchase while the client rents the solar system from them, with potential ownership transfer at the end of the contract. This cost may be factored into rental payments or be an additional payment at the end of the term.

- The typical rental term is between five and seven years
- Payments should be tax deductible.
- Director/Personal Guarantees will be required for all but very strong credits.
- Easy process to implement
    - Portals for quotes
    - Transparent Interest rates
- Interest Rates will be higher than on balance sheet loans

In Figure 6, the green line represents the rental payments. The red line represents the self-funded position, that is, it includes the initial cost and savings of the system. The yellow line is the net of the other two lines, being the position of the borrower when enjoying the benefit of the system while paying to rent it. Ideally the borrower remains 'cash flow' positive throughout the arrangement with the rental cost being lower than the business as usual energy costs. Again, some savings may need to be retained in advance of year 10 when the inverter is assumed to be replaced.

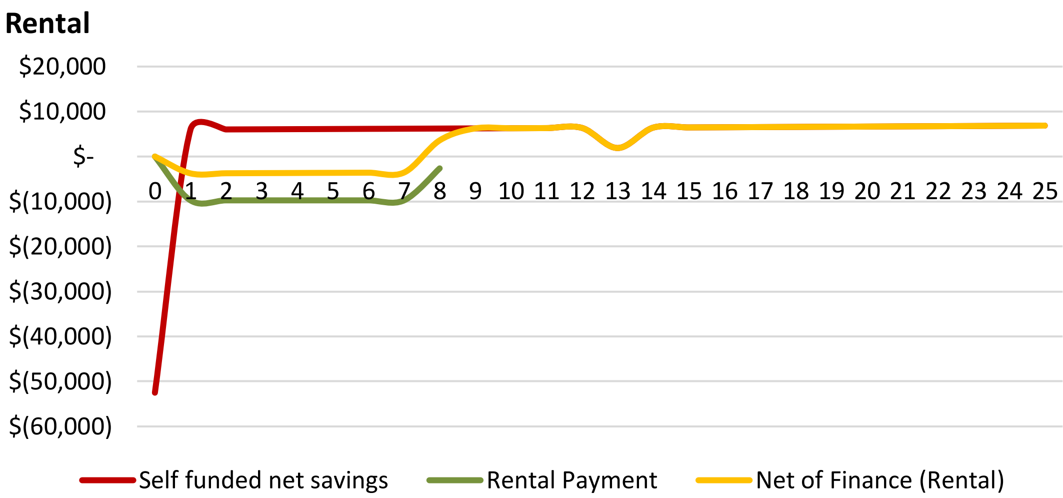

Figure 6: Rental option cash flow comparison

A summary of the rental option is shown in Table 4.

Table 4: A summary of the pros and cons of the rental agreements

Rental agreement option	Description	Advantages	Disadvantages
Operating lease	The equipment is owned by the financier and the customer obtains the sole right to use it. The customer pays regular rental (or lease) payments to financier and pays all maintenance costs. At the end of the lease, the customer has the option of returning the equipment, making an offer to buy it, or continuing to lease it.	No or reduced up-front cost. Limited collateral /security required (other than the asset). Leasing costs are tax deductable. Fixed lease payments (known capital outlay). Lease obligation is off-balance sheet. Financier bears 'residual value risk' (e.g. risk that the equipment has no value at the end of the lease). Particularly suitable where equipment has perceived high obsolescence or is required for a short period e.g. diesel genset	Customer bears the risk of the equipment becoming unusable during the lease. Customer cannot depreciate the asset. More suitable for capital intensive projects and where costs are mainly for physical assets. e.g. Rooftop solar would be more applicable than ground-mount where a large portion of costs are for installation and associated services. Less suitable when equipment is difficult to remove or reuse (such as ground mounted solar)
Capital lease	Same as operating lease, except that at the end of the lease, equipment ownership transfers to the customer on payment of an agreed amount.	No or reduced up-front cost. Fixed lease payments Customer depreciates the equipment. Interest component of repayments are tax deductable.	The lease obligation appears on the balance sheet. Customer bears the economic risk of the equipment becoming unusable, including the 'residual risk'. As for operating lease, more suitable for capital intensive projects and where costs are predominantly for physical assets. e.g. solar

Power Purchase Agreements (PPAs)

Solar system installed at $0 upfront as it is owned by the provider (may be termed funding partner) who then charges an agreed rate in c/kWh for solar generation, to the landholder (customer), for a set period.

This is not financing but rather on-going service provision including insurance, operation and maintenance (O&M). The provider assumes generation risk and sometimes warrants minimum generation.

- Terms are varied from seven to twenty years
- Fixed payments are for electricity and should be tax deductible.
- Exporting income may potentially be retained by the customer through existing retailer arrangements (other models also) and should be reflected in the PPA power price.
- Cost of funds is higher but the risks of ownership for customer is lower (which is important for larger systems).
- Once PPA ends, ownership may be transferred to the customer, who then assumes usual asset risks and costs.

Figure 7 shows an example cash flow for a PPA. In this scenario, the PPA term is 15 years for an agreed power price of 23c/kWh. This pricing also includes the customer obtaining ownership in year 16, when they would also pay for the cost of an updated inverter. At this point the benefits become equal to those of the self funded option.

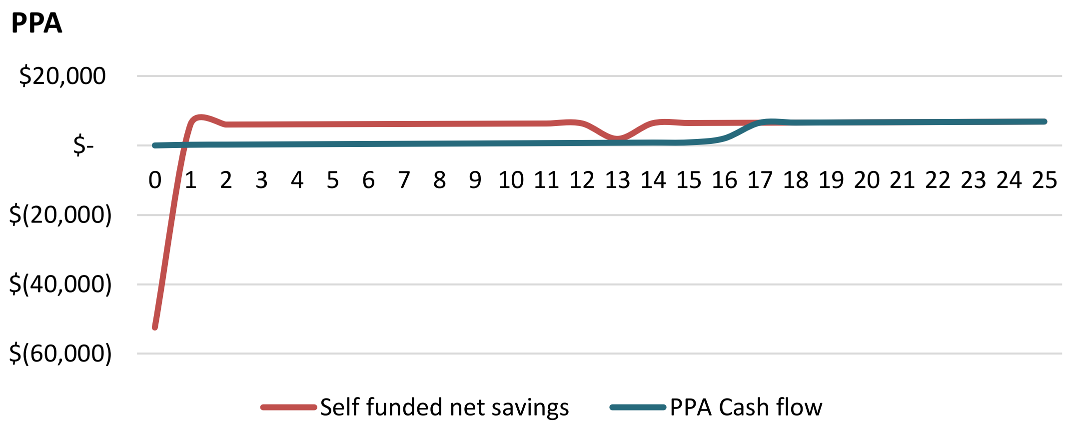

Figure 7: PPA funding option, cash flow comparison to self funded (cash) option

The advantages and disadvantages of a PPA options are summarised in Table 4.

Table 5: A summary of the pros and cons of a PPA

Option	Description	Advantages	Disadvantages
PPA	A PPA provider designs, constructs, owns, operates and finances the energy generation equipment. The customer pays a cost per kWh price for all electricity generated; this price may escalate during the term of the	No upfront capital requirements. Off balance sheet. Designed to replace operating expenditure. Tax deductable expense. No security required as there is no loan.	Cost of energy is higher than other funding options, however the risk of ownership is lower. Can be a complicated contract.

	PPA. To have a PPA, the generator needs to be connected to a revenue-grade meter which must be read monthly or quarterly to determine how much electricity the customer needs to be charged for.		

Important Terms in a Power Purchase Agreement

Solar power purchase agreements (PPAs) can be heavy on details and sometime onerous terms. The principle elements that should be considered when entering into a PPA are listed below.

Production v Consumption

PPAs can be an agreement to purchase the power produced by the solar system (a production PPA) or an agreement to purchase the power consumed from the solar system (a consumption PPA). Productions PPAs look a lot more like a lease than a consumption PPA because the production should be relatively consistent and therefore the payments look like lease payments. The problem here is that the cost of the PPA payments will generally be much higher than an equivalent lease. Consumption PPAs pass more risk to the PPA provider and justify more of the higher costs of a PPA.

Auxiliary charges and fees

Payments per kilowatt of power under a PPA should be simple “all-in” costs and there should not be any auxiliary charges or fees. Insurance, maintenance, metering and billing charges should all be covered by the PPA tariff. This should also cover repairs or equipment failures including inverter replacements which generally occur after ten years.

Insurance and Certifications

Ensure that your property insurance policies are up to date and include the solar power system. It is important to contact your insurance provider to notify of them of the installation. There might be relevant exclusions that need attention. While the PPA provider will have its own insurance policy it is important to review it and observe how it interacts with your own. Your PPA provider must also ensure that its installers carry the appropriate certifications and insurances.

End of term transfer

PPAs have a few different potential outcomes at the end of their term. You could agree to purchase the solar system, it could transfer to you at no cost or the PPA provider could remove the system. Usually these options are articulated in the PPA so it’s important to discuss what happens to the system at the end of the term. It is also important to check the ways that the PPA can end, for instance you may wish to buy out the system before the end date. Be conscious of the costs and ensure the method of calculating these is agreed upfront.

Export Tariffs

When the power produced from the solar system exceeds the power being consumed then the solar system will export power to the grid. The power exported usually receive a tariff often known as a feed in tariff (FiT) and it is important to know whether the PPA provider or you receives the benefit of this.

Monitoring and Verification

It is important to know how your solar system is operating. Is it on? Is it producing as much as it should be? Does it need cleaning? It is also important to be able to analyse the performance to know if it is oversized, undersized or needs augmentation.

Comparing the funding options

The net benefit of an investment can be considered using a cumulative cash flow. The cumulative cash flows of the four funding options are compared in Figure 8.

The green line represents the cash (or self funded) option, that is, it includes the initial cost and savings of the system. This is the highest cumulative cash flow of all the options.

The purple line indicates the commercial loan option which is the position of the borrower enjoying the benefit of the system while paying it off over time. This option has the second highest cumulative cash benefit.

The blue line is the rental option where the customer has a longer rental period to enable transfer of ownership at the end of the term. This option requires minimal additional funds as the rental payments are only slightly higher than the 'business as usual' energy payments, however the cumulative net savings are lower as a result of the long rental period.

In this example the lowest cumulative cash flow is the PPA. This example is cash flow positive from year one, making it attractive for the early years of the investment. In year 16 ownership transfers to the land owner, however due to the extended period of marginal benefit, the cumulative cash flow is the lowest of all four options.

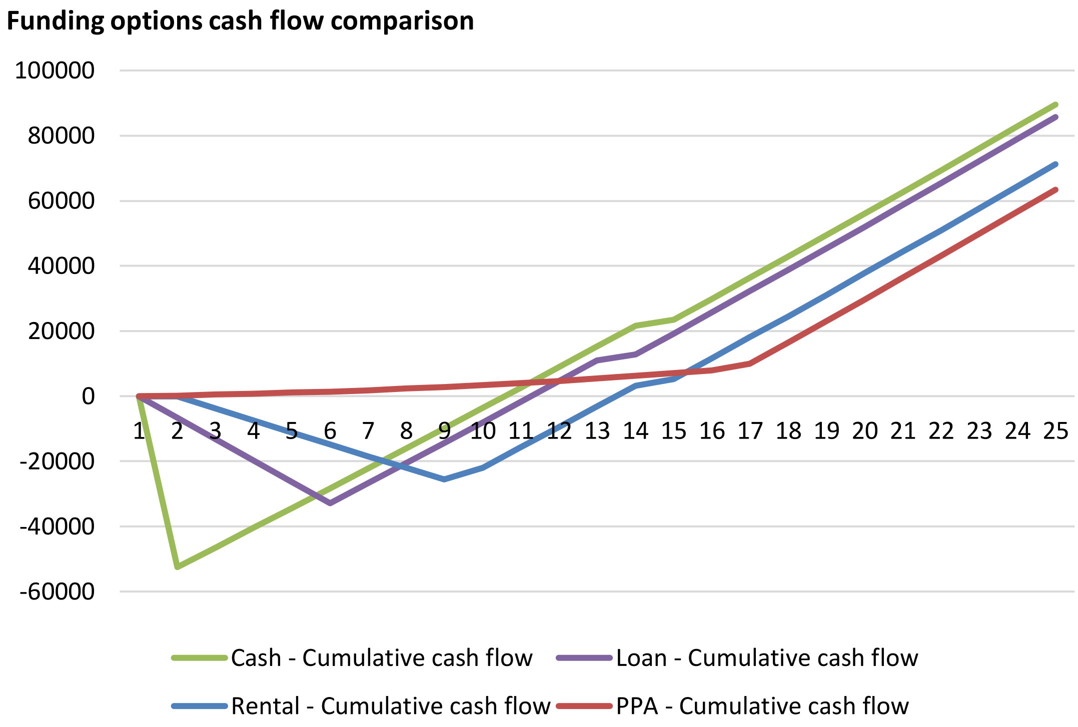

Figure 8: Cumulative cash flow comparison of funding alternatives

Common Finance Terms

General finance terms for external finance options are outlined below. The actual terms offered by a financier will depend on your circumstances, the nature of your project and the prevailing market conditions.

Finance terms largely depend on the risks borne by financiers. When these risks are perceived as high (in terms of higher default risk or lower value of collateral or other security) the finance terms become less attractive for financiers.

Below is a list of finance terms and how they are affected by their associated risks.

Finance period: the period over which financiers are willing to provide finance. Longer finance periods increase risk for the financier; therefore this period is generally reduced as other risks increase. Alternatively, as the finance period increases, other terms generally become less favourable for the borrower.

Finance amount: the amount of finance provided. The amount available to the customer will generally be dependent upon the customer's ability to service the finance repayments and with the value of collateral and other security provided. There is generally a minimum amount, as the expected return for financiers must be sufficient to exceed the cost they incur when providing finance.

Finance percentage: the percentage of the required capital expenditure for which finance is provided. This can be up to 100% for all finance options. However, in practice this varies, like finance rates, between projects and applicants for the same finance product. Financiers are generally willing to finance a larger portion of project cost as risk decreases.

Inclusion of soft costs: the percentage of total finance that can be used for non-asset items, such as installation costs and professional service fees.

Drawdowns: the customer receives finance in stages to align with project expenditure. This increases the risk for the financier as the full collateral is not available until project expenditure is complete. As risk increases the borrower's ability to drawdown will decrease.

Residual value/balloon payment: leases can be structured with a residual value, which is the assumed value of the asset at the end of the lease. This reduces the required repayments and, for capital leases, must be paid to the financier at the end of the lease for the customer to gain ownership of the asset. Loans can be structured with a balloon payment, which is a large portion of principal to be repaid at the end of the loan. This reduces the periodic payments during the term of the loan. In the case of leases, the size of residual value depends on the ability for the asset to be removed from the customer's site and resold. In both cases, the allowable residual value or balloon payment decreases as overall risks increase.

Finance cost: the required return financiers use to calculate finance repayments, such as the interest rate on a loan. Indicative rates are not provided, as they are highly dependent on the customer, project and prevailing market conditions; however the finance cost increases with increasing risk.

Source: Energy Efficiency and Renewables Finance Guide, 2014, NSW Office of Environment and Heritage.

Larger scale energy projects

Further consideration needs to be given for behind the meter commercial renewables greater than 100kW, and utility scale /in front of meter projects (which can be 100MW plus). When registered as a power station, a large-scale project can create an income stream through LGCs (as explained in section 2. Regulatory landscape).

For these type of projects (if output is contracted):

- There is a deeper investment market
- Two incomes streams (sale of energy and LGCs)
- Longer gestation period due to stakeholders and procurement process (i.e. tender)
- Funding solutions are available and contracted output projects are valuable to several funding types

This scale of project is unlikely to be required for offsetting the energy requirements of seasonal sugarcane irrigation. However there are agricultural applications where investment works. Figure 9 shows a 500kW solar system installed in 2018 on a broad acre irrigation farm near Narromine, NSW. The system runs a 250kW electric motor by day, supported by a 500 KVA diesel generator for nights and cloudy days. Registered as a power station, the site generates LGCs through the RET, this income stream combined with offset traditional energy means the investment has an estimated payback of 5 years.

Figure 9: 500kW solar system on a farm near Narromine, NSW (Photo source: ReAqua)

CASE STUDY EXAMPLES

5. Case study examples

This report compares the financial impact of applying various funding options for energy innovation to the irrigation of sugarcane under fixed conditions. The comparison looks at the economics of each alternative, not the efficiency of the system.

Energy efficiency measures should be considered concurrently with co-generation to investigate areas offering the highest returns.

Previous reports by Powell & Welsh[7] show that renewables can feasibly supplement energy requirements for irrigating sugarcane. The two key variables underpinning the feasibility in the current policy climate for a seasonal irrigation profile are;

- Remaining eligible for a feed in tariff (limiting the rated size of the system to 30kW inverter – 39kW solar) and;
- Shifting the load (where irrigation scheduling allows) to daylight hours.

Seeking advice

The engineering design of the irrigation system can have a large impact on the ongoing operational cost. High pressure systems with inefficient pumps can lead to more power consumption that reduces the enterprise's profitability.

To reduce energy costs every effort should be made to reduce any restriction in the system which could lead to increased pressure in the system and higher pumping costs. Over time all pumps and equipment wear, resulting in efficiency falls. This may be a slow process and can go unnoticed.

As the area of irrigation design and engineering is relatively complex many growers may find it useful to engage the services of a specialist irrigation design and assessment consultant. A number of these consultants work throughout the industry and can conduct an irrigation system audit to identify if economic changes can be made to the irrigation system to reduce operating costs.

Case study finance scenarios

There are an endless combination of terms and conditions that can be found in finance scenarios. Below are the key terms and assumptions made in the following case study comparison.

- **Commercial loan / equipment finance:** 5 year term, 6.5% interest rate, inverter replacement year 13
- **Rental:** 7 year term, 7% interest rate, 5% (of capital cost) balloon payment (for ownership transfer at the end of the term), inverter replacement year 13
- **Power Purchase agreement:** 15 year term, $0.23/kW power price, ownership transfer at the end of the term (without additional payment because this is factored into the power price), customer pays for new inverter in year 16 (once owned)
- **Common assumptions**
    - Feed in tarrif: $0.105/kW
    - Solar cost (including inverter & ground mounts suitable for cyclone areas): $1750/kW
    - Discount rate: 7%

[7] SRA Case study Fact Sheet 2019 https://static1.squarespace.com/static/59af474b197aea0fbfcf6be1/t/5c834f5e4e17b67945633450/1552109464954/SRA+Energy+Study+-+Fact+Sheet.pdf

Case study locations

Figure 10: Location of two case study sites

Case Study 1 – Burdekin, (Wilmar, Ayr)

Wilmar operates one of Australia's most significant sugarcane farming operations, farming around 6,600 hectares (ha) of agricultural land within the Herbert, Burdekin, Proserpine and Plane Creek milling regions. Of this total area, 3,500ha is farmed in the Burdekin, with water supplied from the Burdekin Haughton Water Supply Scheme. An image of a stationary pump typical of those on the farm is shown in Figure 11. This analysis provides an overview of the outcomes of each finance option available. Details of the site are listed below.

Site, demand profile, energy solutions

Assumptions

- A single, stationary pump (size: 22kW)
- Flood irrigation scenario (pumping 24hrs a day, roughly 75 days a year)
- Tariff 20

Optimal energy solution

- Install 30kW solar (ground mounted), remaining grid connected, capital cost $52,500 and ensuring appropriate mounting for cyclone prone areas.
  A renewable installation of this size ensures the site remains eligible for a feed-in-tariff of 10.5c/kW. The grid remains an effective 'back-up' when the solar doesn't have enough light to generate sufficient power for the load
- There is minimal administration required to connect and receive a Feed in tariff

Figure 11: A grid-connected stationary pump at Wilmar farms, Ayr.

Comparison of finance options

Table 6 provides a summary of the basic economic metrics of each finance scenario. The summary shows the cash purchase as the highest total cumulative cash flow over the 25-year investment scenario. On the flip-side of this benefit, this finance option also shows the greatest amount of risk. The detailed cash flow tables for this analysis can be found in Appendix 2.

Table 6: Ayr case study economic results of each finance scenario

Finance type	Cash flow positive at year	Break-even year (if applicable)	Cumulative cash flow at Year 25	NPV	IRR
Cash	1	10	$103,248	$17,676	11%
Loan	6	11	$92,581	$18,331	13%
Rental	8	13	$84,932	$16,248	13%
Power Purchase Agreement (PPA)	1	n/a	$70,268	$18,400	n/a

As detailed in Appendix 1, the NPV of an investment discounts future cash flows. The common phrase 'a dollar in my hand today is worth more than a dollar in the future', indicates the time value of money. This is why future cash flows are discounted. While the PPA agreement has the lowest nominal cumulative cash flow, when the income streams are discounted it has the highest NPV, because it is the only option without a capital outlay and the cash flow remaining positive in the early years of the investment. Figure 12 shows the various cash flow and NPV positions under each option. The solution most suitable to the customer comes down to the appetite for risk, capital and tax management of the business.

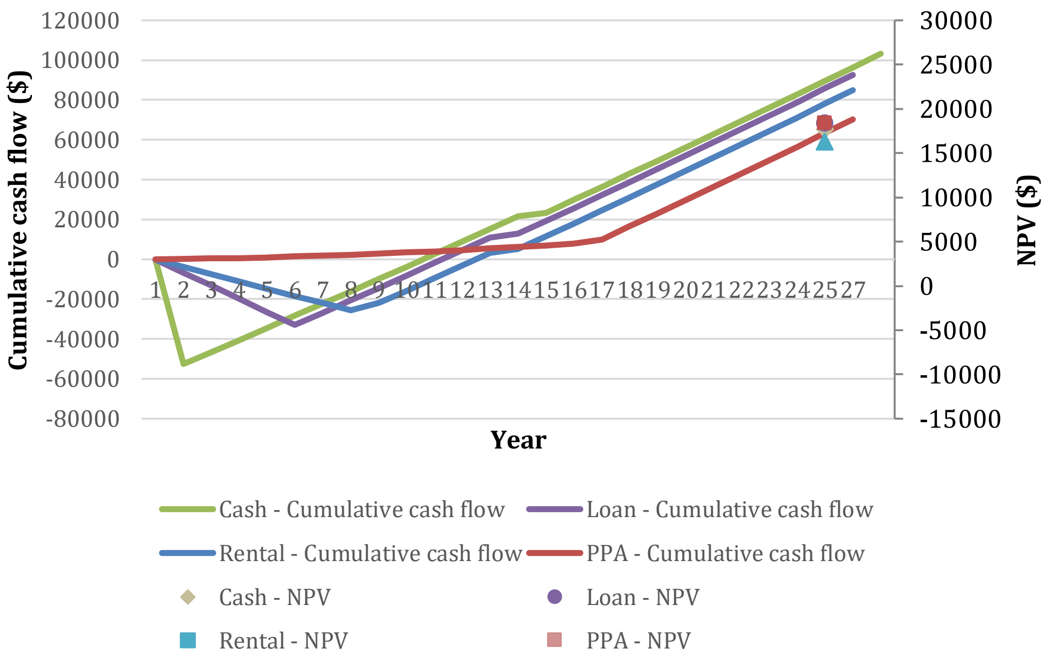

Figure 12: Cumulative cash flow of finance options

As previously shown by AgEcon[8], where the electric load can be shifted into daylight hours to ensure the maximum amount of grid energy can be offset by solar energy, the payback improves. Table 7 summarises the financial outcomes under the shifted-load scenario. For Wilmar, where the load is shifted into daylight hours for 180 days a year, the economic returns improve (the project has a quicker break even period, a higher cumulative cash flow, NPV and IRR), and the ranking of the funding options also changes. Cash remains a strong option as does a commercial loan (or equipment finance). As the solar energy is being utilised more, the PPA option becomes less attractive (as the solar energy is at only a marginal discount to the grid energy) and there is less energy to sell back to the grid. The detailed cash flow tables for this analysis can be found in Appendix 2.

Table 7: Results for the Wilmar 22 kW pump under the shifted-load scenario

Finance type	Cash flow positive at year	Break-even year (if applicable)	Cumulative cash flow at Year 25	NPV	IRR
Cash	1	7	$174,444	$45,993	16%
Loan	6	8	$163,777	$46,648	24%
Rental	8	9	$156,128	$44,565	29%
Power Purchase Agreement (PPA)	1	n/a	$115,476	$31,970	n/a

[8] Powell, J.W and Welsh, J.M (2018). *Integrating alternative energy solutions: irrigated cane.* Available online: https://www.agecon.com.au/media-publications-1

Case Study 2 – Tablelands (Balzarolo, Dimbulah)

The Balzarolo family operates a cane farm near Mareeba on the Tablelands region of far north Queensland. Edward Balzarolo has installed 16ha of drip irrigation on his farm. This drip field is serviced by a 55kW grid-connected pump (Figure 13) which is also utilised to water other other irrigated fields using pivots. The analysis carefully mapped the usage patterns of the drip irrigation portion serviced by the large pump. Previous analysis by AgEcon[9] suggests the optimal solution is to stay within the size limits set by Ergon to attract a FiT, hence the 39 KW of PV chosen. This case study defines the pump under analysis and compares each finance option.

Funding options for the optimal solution

Assumptions

- A single, stationary pump (size: 55kW)
- Drip irrigation scenario across 16 ha
- Average operating hours 72 hrs per week
- Average water budget is 15 ML/ha
- Tariff 62

Optimal energy solution

- Install 39kW solar, remaining grid connected, capital cost $68,250 (cost includes solar panels, inverter and ground mount structure suitable for cyclone prone areas)
  A renewable installation of this size ensures the site remains eligible for a feed-in-tariff of 10.5c/kW. The grid remains an effective 'back-up' when the solar doesn't have enough light to generate enough power for the load
- Usage pattern is highly variable and dependent on in-crop rainfall
- Minimal administration required to connect and receive a Feed in tariff

Figure 13: 55kW grid-connected pump in the Tablelands.

[9] Powell, J.W and Welsh, J.M (2018). *Integrating alternative energy solutions: irrigated cane.* Available online: https://www.agecon.com.au/media-publications-1

A comparison of Finance options

Figure 14 shows a higher cumulative cash flow with the Cash and Loan options, all the NPV are quite closely grouped.

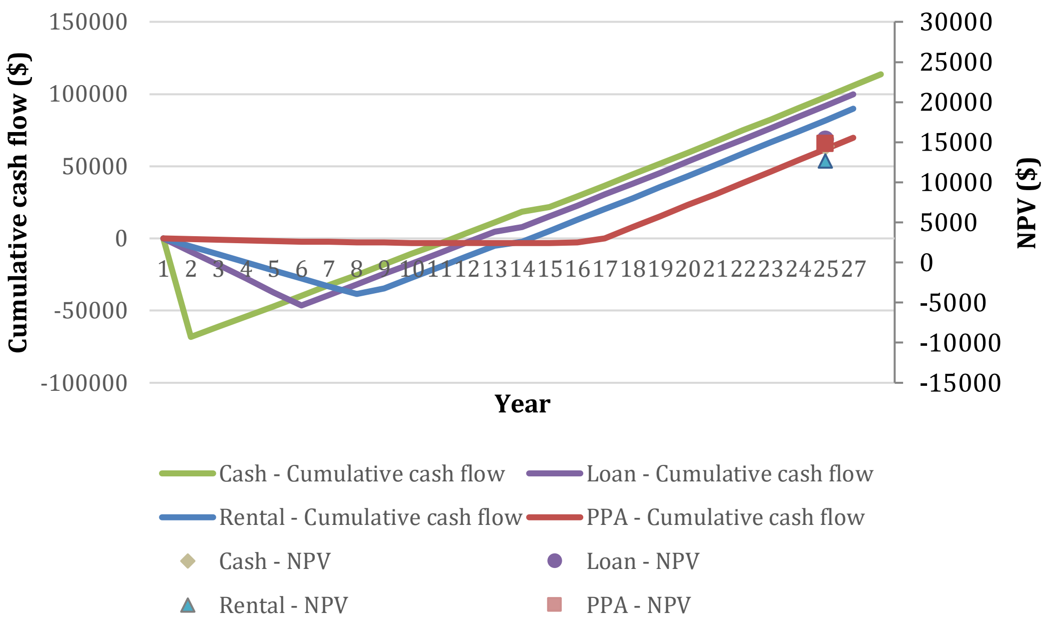

Figure 14: Cumulative cash flows and NPV for each finance option applied to a 39kW PV installation

The results are summarised in Table 8. These show slower economic returns than case study one, because the renewable installation is not sized to cover the load (but limited to ensure a FiT). Also, the farmer is currently only irrigating during off peak so the marginal difference between the cost of solar and the existing tariff is low. And, due to the existing off peak irrigation, the PPA power purchase price starts higher than the existing price being paid making this a cash flow negative option until year 16.

Table 8: Economic comparison of finance results for Tablelands, drip irrigation

Finance type	Cash flow positive at year	Break-even year (if applicable)	Cumulative cash flow at Year 25	NPV	IRR
Cash	1	11	$113,647	$14,480	9%
Loan	6	14	$99,780	$15,332	11%
Rental	8	15	$89,836	$12,624	11%
Power Purchase Agreement (PPA)	12	16	$69,697	$14,733	n/a

Table 9 demonstrates where the load is shifted to day light only, economic returns improve. The shift to daylight also requires a change from a time of use tariff to a flat tariff to keep the grid energy price as low as possible during the day when most of the irrigating is happening. As in the Wilma case study, the more the renewable investment is utilised, the less attractive the PPA option becomes.

Table 9: Economic comparison of finance results for Tablelands, drip irrigation (day light only)

Finance type	Cash flow positive at year	Break-even year (if applicable)	Cumulative cash flow at Year 25	NPV	IRR
Cash	1	8	$194,917	$47,111	14%
Loan	6	9	$181,051	$47,963	20%
Rental	8	9	$171,107	$45,255	22%
Power Purchase Agreement (PPA)	1	n/a	$130,054	$35,496	n/a

The detailed cash flow tables for each case study and finance option can be found in *Appendix 2 – Case study, cumulative cash flow tables*.

CONCLUSION

6. Conclusion

The use of small scale solar electric generation in Australia has been steadily rising in recent years. While solar PV installs have been extensively used for residential application, irrigators are increasingly considering opportunities for co-generation for grid-connected irrigation plant. Capital budgeting and new finance products play a critical role in facilitating the implementation and uptake of new energy technologies.

Systems can be purchased outright using cash or traditional debt financing (includes equipment finance). There are incentives to access funds at below market rates through the CEFC interest subsidies and QRIDA low-interest loans. In these instances, the irrigator bears the equipment performance risks and all O&M. Provided the investment is feasible, these options offer the highest cumulative cash flow and generally the highest Net Present Value over the investment period.

Rentals (may also be termed leasing) are economical for the lessee if the combination of monthly leasing fees and the reduced cost of grid consumption are lower than costs when compared with a business as usual scenario (sourcing from the grid-only). O&M costs and inflation are often included in the finance terms. A range of options exists for the instalments and ownership at the end of the term.

Case study analyses found the PPA option to offer the lowest cumulative cash flow over the investment period. However, the key benefit of this option is that no up-front payments are required so that in some scenarios this is a cash flow positive option to reduce energy costs. Also, there are little to no time requirements for the installation and ongoing maintenance of the system. While PPAs contractual obligations are often detailed and complex, once these are understood, they can offer a low-risk alternative for irrigators. There are potential ownership options at the end of the contract term. It is important to note that the PPA energy pricing is a key driver of the long-term savings accumulated.

Choosing the method of finance ultimately rests with the irrigators risk profile, individual tax circumstance regarding depreciation and the personal time commitment or capacity available to manage the investment. Prior to exploring options for energy technology finance, basic feasibility based on a hypothetical cash transactions can prove a useful sign post prior to committing to long-term agreements. Irrigators should also seek advice from their trusted financial advisor.

Acknowledgements

David Lukas from Smart Energy Services provided oversight to the preparation of this report to ensure technical and market accuracy. David's expertise on the subject is gratefully acknowledged and appreciated. AgEcon would also like to thank Wilmar (Ayr), Edward Balzarolo (Dimbulah) and David Srhoj (Tablelands) for their co-operation during the case study assessments.

7. Appendix 1 – Financial appraisal methods in detail

Simple payback period

The simple payback period is the time it takes for the upfront cost of an investment to be recovered from the savings generated by the investment.

A business should invest in a project if it has a payback period less than the target payback period.

The payback period is calculated as follows:

Simple payback period = Upfront investment Savings per period

	Advantages	Disadvantages
Simple payback period	Very simple to calculate and understand. Most useful when a business has a very limited amount of money to invest. In this case, it is generally very important to recover upfront investment costs quickly so other investments can be made	Does not consider the time value of money, that is, that cash received today is more valuable than the same amount of cash received in the future. Does not consider the value of cash flows that occur after the payback period e.g. a project delivering the same cash inflows for five years after the payback period is more valuable than one delivering the same cash flow for two years after the payback period.

Net Present Value

The NPV is the present value of all cash flows generated by a project. All cash inflows and outflows are discounted to present value using a target rate of return. The target rate of return is the return you need from an investment and is generally based on the interest rate for any debt you have and the return required by the owners of the business.

A business should invest in a project if its NPV is positive or zero, as this means the project delivers the required return on investment or more. If selecting between projects, invest in those projects with the highest NPVs.

$$NPV = \sum_{t=1}^{n} \frac{C_t}{(1-r)^t} - C_0$$

The NPV is calculated as follows:

Where:

C_0 = upfront investment

C_t = cash flow in period t

t = the time period

n = the total number of periods

r = the discount rate

	Advantages	Disadvantages
Net present value	Accounts for the time value of money. Easy to understand. Determines how profitable a project will be in comparison to alternatives.	Sensitive to the discount rate used, which is especially important as each business will have its own equity return expectations. Running sensitivity analyses is important.

Internal Rate of Return

The IRR is the discount rate that makes the net present value of all cash flows from an investment equal to zero.

IRRs can be used to prioritise competing projects; generally, the higher the IRR, the more attractive the project. A business should invest in projects with an IRR above the required rate of return.

The IRR is calculated by determining the discount rate for which the NPV is zero, as follows:

Where

$$0 = \sum_{t=1}^{n} \frac{C_t}{(1 - IRR)^t} - C_0$$

C_0 = upfront investment

C_t = cash flow in period t

t = the time period

n = the total number of periods

r = the discount rate

	Advantages	Disadvantages
IRR	Allows all projects to be compared against the same benchmark – the required return. Most useful when assessing individual projects, not those which are mutually exclusive.	Does not determine the value that a project will add to a firm. Two projects with the same IRR can be of different sizes and provide significantly different cash inflows to a business over their lifetimes. As a result, it is difficult to select between mutually exclusive projects using IRRs. Is difficult to calculate if there are negative cash flows during the project's life (e.g. due to replacement of large parts)

Levelized cost of energy

The Levelized cost of energy (LCOE) is the Net Present Value of the unit-cost of electricity over the lifetime of a generating asset. Where the *Unit cost* equals the total (capital and operating) costs divided by the total number of kWhs generated over the solar system's economic life.

The difference between the contracted electricity price and the levelized cost of energy is the avoided cost, which is the main benefit of renewable energy installations. Figure 15 highlights this concept by state. The more that is being paid for electricity, the greater the benefit of avoided costs. Those on business tariffs will generally experience a lower avoided cost per kWh. However the higher volume of grid energy offset by renewable energy can still make renewables a viable investment.

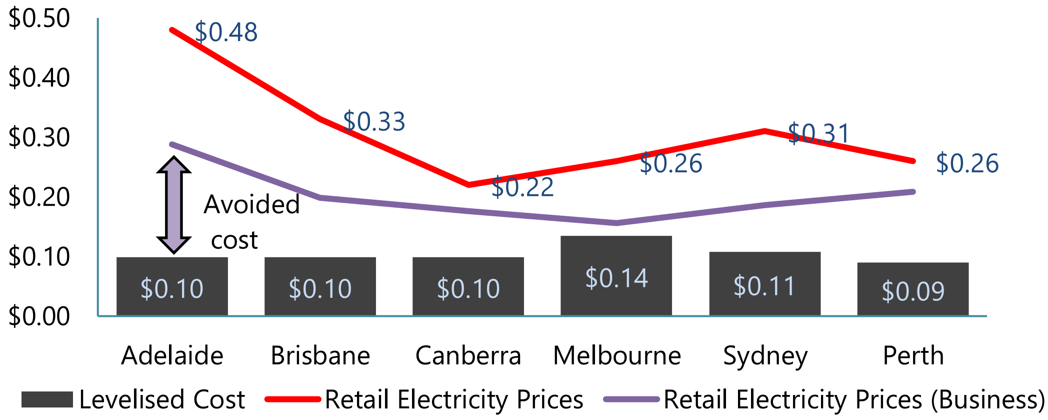

Figure 15: Levelized cost of a 30 kW rooftop PV system vs retail electricity price for business A$/kWh (Smart Energy Services 2019)

	Advantages	**Disadvantages**
LCOE	A simple metric easily understandable. Easy comparison between energy generation sources	Doesn't promote energy efficiency as the more energy used the cheaper the LCOE (due to the equation dividing the total costs by the number of consumed kW) The 'per unit value' should be less important than the lifetime system cost. A financial metric such as NPV is more relevant to decision making

8. Appendix 2 – Case study, cumulative cash flow tables

Ayr, flood irrigating 24hrs a day (business as usual irrigation schedule)

Table 10 and Table 11 outline the annual costs for an investment in 30 kW of ground mounted solar panels to lower the energy costs of a 22 kW irrigation bore. These costs reflect a 'business as usual' irrigation schedule where the bore is turned on (and left on) as needed, running both days and nights. The results are discussed in Chapter 5.

Table 10: Ayr, flood irrigation, cumulative cash flow table, cash (self-funded investment)

	Solar benefits		Solar Costs		Cash		
Year	**Savings**	**Feed in Tariff**	**Insurance**	**Inspection + O&M**	**Equipment purchases**	**Cash - net savings**	**Cash - Cumulative cash flow**
0			0		-52500	-52500	-52500
1	2475	4019	-300	-200	0	5994	-46506
2	2518	4019	-308	-205	0	6025	-40480
3	2563	4019	-315	-210	0	6057	-34424
4	2608	4019	-323	-215	0	6089	-28335
5	2653	4019	-331	-221	0	6121	-22214
6	2700	4019	-339	-226	0	6154	-16060
7	2747	4019	-348	-232	0	6187	-9874
8	2796	4019	-357	-238	0	6221	-3653
9	2845	4019	-366	-244	0	6255	**2602**
10	2895	4019	-375	-250	0	6289	8891
11	2945	4019	-384	-256	0	6325	15216
12	2997	4019	-394	-262	0	6360	21576
13	3050	4019	-403	-269	-4500	1897	23473
14	3103	4019	-414	-276	0	6433	29906
15	3158	4019	-424	-283	0	6471	36377
16	3213	4019	-434	-290	0	6508	42885
17	3269	4019	-445	-297	0	6547	49431
18	3327	4019	-456	-304	0	6585	56017
19	3385	4019	-468	-312	0	6625	62642
20	3445	4019	-480	-320	0	6665	69306
21	3505	4019	-492	-328	0	6705	76011
22	3567	4019	-504	-336	0	6746	82757
23	3629	4019	-516	-344	0	6788	89545
24	3693	4019	-529	-353	0	6830	96375
25	3758	4019	-543	-362	0	6873	103248
						103248	
					Cash NPV	$17,676	
					Cash IRR	11%	

Table 11: Ayr, flood irrigation, cumulative cash flow tables; Loans / Rentals / PPA's

	Loan			Rental			Power Purchase Agreement			
Year	Loan repayments ($)	Net of Finance ($)	Loan - Cumulative cash flow ($)	Rental Payment ($)	Net of Rental payments ($)	Rental - Cumulative cash flow ($)	Avoided Electricity Purchase at @ 25c/kWh ($)	15 year PPA @ 23c/kWh ($)	Net PPA Position ($)	PPA - Cumulative cash flow ($)
0	0	0	0	0	0	0	0	0	0	0
1	-12633	-6639	-6639	-9742	-3747	-3747	2475	-2277	198	198
2	-12633	-6608	-13247	-9742	-3716	-7463	2518	-2277	241	439
3	-12633	-6577	-19823	-9742	-3685	-11148	2563	-2277	286	725
4	-12633	-6545	-26368	-9742	-3653	-14801	2608	-2277	331	1056
5	-12633	-6512	-32881	-9742	-3621	-18422	2653	-2277	376	1432
6		6154	-26727	-9742	-3588	-22010	2700	-2277	423	1855
7		6187	-20540	-9742	-3555	-25564	2747	-2277	470	2325
8		6221	-14320	-2625	3596	-21969	2796	-2277	519	2844
9		6255	-8065		6255	-15714	2845	-2277	568	3411
10		6289	-1775		6289	-9425	2895	-2277	618	4029
11		6325	**4549**		6325	-3100	2945	-2277	668	4697
12		6360	10910		6360	**3261**	2997	-2277	720	5417
13		1897	12806		1897	5157	3050	-2277	773	6190
14		6433	19240		6433	11590	3103	-2277	826	7016
15		6471	25710		6471	18061	3158	-2277	881	7897
16		6508	32218		6508	24569	2008		2008	9905
17		6547	38765		6547	31116	6547		6547	16451
18		6585	45350		6585	37701	6585		6585	23037
19		6625	51975		6625	44326	6625		6625	29662
20		6665	58640		6665	50990	6665		6665	36326
21		6705	65345		6705	57696	6705		6705	43031
22		6746	72091		6746	64442	6746		6746	49777
23		6788	78879		6788	71229	6788		6788	56565
24		6830	85709		6830	78059	6830		6830	63395
25		6873	92581		6873	84932	6873		6873	70268
	-63167			-70816	84932		104423	-34155	70268	
	Loan NPV	$18,331		**Rental NPV**	$16,248		**PPA NPV**	$18,400		
	Loan IRR	13%		**Rental IRR**	13%		**PPA IRR**	n/a		

Ayr, flood irrigating, daylight shifts (alternative irrigation schedule)

Table 12 and Table 13 outline the annual costs for an investment in 30 kW of ground mounted solar panels to lower the energy costs of a 22 kW irrigation bore. These costs reflect a 'shifted load' irrigation schedule where the bore is only used during daylight hours to maximise electricity offset by solar. The results are discussed in Chapter 5.

Table 12: Ayr, flood irrigation, cumulative cash flow table, cash (self-funded investment), daylight irrigation

	Solar benefits		Solar Costs		Cash		
Year	Savings ($)	Feed in Tariff ($)	Insurance ($)	Inspection + O&M ($)	Equipment purchases ($)	Cash - net savings ($)	Cash - Cumulative cash flow ($)
0			0		-52500	-52500	-52500
1	5940	2564	-300	-200	0	8004	-44496
2	6044	2564	-308	-205	0	8096	-36400
3	6150	2564	-315	-210	0	8189	-28211
4	6258	2564	-323	-215	0	8284	-19927
5	6368	2564	-331	-221	0	8380	-11547
6	6480	2564	-339	-226	0	8478	-3068
7	6594	2564	-348	-232	0	8578	**5509**
8	6709	2564	-357	-238	0	8679	14188
9	6827	2564	-366	-244	0	8782	22970
10	6947	2564	-375	-250	0	8887	31857
11	7069	2564	-384	-256	0	8993	40850
12	7193	2564	-394	-262	0	9101	49951
13	7319	2564	-403	-269	-4500	4711	54661
14	7448	2564	-414	-276	0	9322	63984
15	7578	2564	-424	-283	0	9436	73419
16	7711	2564	-434	-290	0	9551	82971
17	7847	2564	-445	-297	0	9668	92639
18	7984	2564	-456	-304	0	9788	102427
19	8124	2564	-468	-312	0	9909	112335
20	8267	2564	-480	-320	0	10032	122367
21	8412	2564	-492	-328	0	10157	132524
22	8560	2564	-504	-336	0	10284	142808
23	8710	2564	-516	-344	0	10413	153221
24	8863	2564	-529	-353	0	10545	163766
25	9018	2564	-543	-362	0	10678	174444
						174444	
					Cash NPV	$45,993	
					Cash IRR	16%	

Table 13: Ayr, flood irrigation, cumulative cash flow tables; Loans / Rentals / PPA's, daylight irrigation

	Loan			Rental			Power Purchase Agreement			
Year	Loan repayments ($)	Net of Finance ($)	Loan - Cumulative cash flow ($)	Rental Payment ($)	Net of Rental payments ($)	Rental - Cumulative cash flow ($)	Avoided Electricity Purchase at @ 25c/kWh ($)	15 year PPA @ 23c/kWh ($)	Net PPA Position ($)	PPA - Cumulative cash flow ($)
0	0	0	0	0	0	0	0	0	0	0
1	-12633	-4629	-4629	-9742	-1737	-1737	5940	-5465	475	475
2	-12633	-4537	-9167	-9742	-1646	-3383	6044	-5465	579	1055
3	-12633	-4444	-13611	-9742	-1552	-4936	6150	-5465	686	1740
4	-12633	-4349	-17960	-9742	-1458	-6393	6258	-5465	793	2534
5	-12633	-4253	-22213	-9742	-1361	-7754	6368	-5465	903	3437
6		8478	-13735	-9742	-1263	-9018	6480	-5465	1015	4452
7		8578	-5157	-9742	-1164	-10181	6594	-5465	1129	5581
8		8679	**3522**	-2625	6054	-4127	6709	-5465	1244	6825
9		8782	12304		8782	**4655**	6827	-5465	1362	8187
10		8887	21190		8887	13541	6947	-5465	1482	9670
11		8993	30183		8993	22534	7069	-5465	1604	11274
12		9101	39284		9101	31635	7193	-5465	1728	13002
13		4711	43995		4711	36345	7319	-5465	1854	14856
14		9322	53317		9322	45668	7448	-5465	1983	16839
15		9436	62753		9436	55104	7578	-5465	2113	18952
16		9551	72304		9551	64655	5051		5051	24003
17		9668	81972		9668	74323	9668		9668	33672
18		9788	91760		9788	84111	9788		9788	43459
19		9909	101669		9909	94019	9909		9909	53368
20		10032	111700		10032	104051	10032		10032	63399
21		10157	121857		10157	114208	10157		10157	73556
22		10284	132141		10284	124492	10284		10284	83840
23		10413	142554		10413	134905	10413		10413	94253
24		10545	153099		10545	145450	10545		10545	104798
25		10678	163777		10678	156128	10678		10678	115476
	-63167	163777		-70816	84932		197448	-81972	115476	
	Loan NPV	$46,648		**Rental NPV**	$44,565		**PPA NPV**	$31,970		
	Loan IRR	24%		**Rental IRR**	29%		**PPA IRR**	n/a		

Tablelands, drip irrigating, mostly off peak (business as usual irrigation schedule)

Table 14 and Table 15 outline the annual costs for an investment in 30 kW of ground mounted solar panels to lower the energy costs of a 55 kW irrigation pump. These costs reflect a solar investment using the existing irrigation schedule where the pump is used primarily off peak to minimise grid energy costs (the customer is on tariff 62). The results are discussed in Chapter 5.

Table 14: Tablelands drip Cumulative cash flow table, cash (self-funded investment)

	Solar benefits		Solar Costs		Cash		
Year	**Savings ($)**	**Feed in Tariff ($)**	**Insurance ($)**	**Inspection + O&M ($)**	**Equipment purchases ($)**	**Cash - net savings ($)**	**Cash - Cumulative cash flow ($)**
0			0		-68250	-68250	-68250
1	2445	5225	-390	-200	0	7081	-61169
2	2488	5225	-400	-205	0	7109	-54061
3	2532	5225	-410	-210	0	7137	-46924
4	2576	5225	-420	-215	0	7166	-39757
5	2622	5225	-430	-221	0	7196	-32562
6	2668	5225	-441	-226	0	7225	-25337
7	2714	5225	-452	-232	0	7255	-18081
8	2762	5225	-464	-238	0	7286	-10795
9	2810	5225	-475	-244	0	7317	-3479
10	2860	5225	-487	-250	0	7348	**3870**
11	2910	5225	-499	-256	0	7380	11250
12	2961	5225	-512	-262	0	7412	18662
13	3013	5225	-525	-269	-4500	2945	21606
14	3066	5225	-538	-276	0	7478	29084
15	3120	5225	-551	-283	0	7511	36595
16	3174	5225	-565	-290	0	7545	44141
17	3230	5225	-579	-297	0	7580	51720
18	3287	5225	-593	-304	0	7614	59335
19	3345	5225	-608	-312	0	7650	66984
20	3403	5225	-623	-320	0	7685	74669
21	3463	5225	-639	-328	0	7721	82391
22	3524	5225	-655	-336	0	7758	90149
23	3586	5225	-671	-344	0	7795	97944
24	3649	5225	-688	-353	0	7833	105776
25	3713	5225	-705	-362	0	7871	113647
						113,647	
					Cash NPV	$14,480	
					Cash IRR	9%	

Table 15: Tablelands drip, cumulative cash flow tables; Loans / Rentals / PPA's

	Loan			Rental			Power Purchase Agreement			
Year	**Loan repayments ($)**	**Net of Finance ($)**	**Loan - Cumulative cash flow ($)**	**Rental Payment ($)**	**Net of Rental payments ($)**	**Rental - Cumulative cash flow ($)**	**Avoided Electricity Purchase at @ 25c/kWh ($)**	**15 year PPA @ 23c/kWh ($)**	**Net PPA Position ($)**	**PPA - Cumulative cash flow ($)**
0	0	0	0	0	0	0	0	0	0	0
1	-16423	-9343	-9343	-12664	-5583	-5583	2445	-2960	-515	-515
2	-16423	-9315	-18657	-12664	-5555	-11139	2488	-2960	-472	-987
3	-16423	-9286	-27943	-12664	-5527	-16666	2532	-2960	-428	-1415
4	-16423	-9257	-37201	-12664	-5498	-22163	2576	-2960	-384	-1799
5	-16423	-9228	-46428	-12664	-5469	-27632	2622	-2960	-339	-2137
6		7225	-39203	-12664	-5439	-33071	2668	-2960	-293	-2430
7		7255	-31948	-12664	-5409	-38479	2714	-2960	-246	-2676
8		7286	-24662	-3413	3873	-34606	2762	-2960	-198	-2874
9		7317	-17345		7317	-27289	2810	-2960	-150	-3023
10		7348	-9997		7348	-19941	2860	-2960	-100	-3124
11		7380	-2617		7380	-12561	2910	-2960	-50	-3174
12		7412	**4795**		7412	-5149	2961	-2960	1	-3173
13		2945	7740		2945	-2204	3013	-2960	53	-3120
14		7478	15218		7478	**5274**	3066	-2960	106	-3014
15		7511	22729		7511	12785	3120	-2960	160	-2854
16		7545	30274		7545	20330	3045		3045	**191**
17		7580	37854		7580	27910	7580		7580	7770
18		7614	45468		7614	35524	7614		7614	15385
19		7650	53118		7650	43174	7650		7650	23034
20		7685	60803		7685	50859	7685		7685	30719
21		7721	68524		7721	58580	7721		7721	38441
22		7758	76282		7758	66338	7758		7758	46199
23		7795	84077		7795	74133	7795		7795	53994
24		7833	91910		7833	81966	7833		7833	61826
25		7871	99780		7871	89836	7871		7871	69697
	-82,117	99780		-90061	89836		114099	-44402	69697	
	Loan NPV	$15,332		**Rental NPV**	$12,624		**PPA NPV**	$14,733		
	Loan IRR	11%		**Rental IRR**	11%		**PPA IRR**	n/a		

Tablelands, drip irrigation, mostly daylight (alternative irrigation schedule)

Table 16 and Table 17 outline the annual costs for an investment in 30 kW of ground mounted solar panels to lower the energy costs of a 55 kW irrigation pump. These costs reflect a 'shifted load' irrigation schedule where the pump is only used during daylight hours to maximise electricity offset by solar, the tariff is also changed to a flat rate to minimise the grid energy costs as the solar output doesn't meet the entire energy requirements of the pump. The results are discussed in Chapter 5.

Table 16: Tablelands drip, cumulative cash flow table, cash (self-funded investment), daylight irrigation

	Solar benefits		Solar Costs		Cash		
Year	**Savings ($)**	**Feed in Tariff ($)**	**Insurance ($)**	**Inspection + O&M ($)**	**Equipment purchases ($)**	**Cash - net savings ($)**	**Cash - Cumulative cash flow ($)**
0			0		-68250	-68250	-68250
1	6006	4054	-390	-200	0	9470	-58780
2	6111	4054	-400	-205	0	9561	-49219
3	6219	4054	-410	-210	0	9653	-39566
4	6328	4054	-420	-215	0	9746	-29820
5	6439	4054	-430	-221	0	9842	-19978
6	6552	4054	-441	-226	0	9938	-10040
7	6667	4054	-452	-232	0	10037	-3
8	6784	4054	-464	-238	0	10137	**10133**
9	6903	4054	-475	-244	0	10238	20371
10	7024	4054	-487	-250	0	10341	30713
11	7147	4054	-499	-256	0	10446	41159
12	7273	4054	-512	-262	0	10553	51711
13	7400	4054	-525	-269	-4500	6161	57872
14	7530	4054	-538	-276	0	10771	68643
15	7662	4054	-551	-283	0	10883	79526
16	7797	4054	-565	-290	0	10996	90523
17	7934	4054	-579	-297	0	11112	101635
18	8073	4054	-593	-304	0	11229	112864
19	8215	4054	-608	-312	0	11348	124212
20	8359	4054	-623	-320	0	11470	135682
21	8506	4054	-639	-328	0	11593	147275
22	8655	4054	-655	-336	0	11718	158993
23	8807	4054	-671	-344	0	11845	170838
24	8961	4054	-688	-353	0	11974	182812
25	9119	4054	-705	-362	0	12105	194917
						194,917	
					Cash NPV	$47,111	
					Cash IRR	14%	

Table 17: Tablelands drip, cumulative cash flow tables; Loans / Rentals / PPA's, daylight irrigation

	Loan			Rental			Power Purchase Agreement			
Year	**Loan repayments ($)**	**Net of Finance ($)**	**Loan - Cumulative cash flow ($)**	**Rental Payment ($)**	**Net of Rental payments ($)**	**Rental - Cumulative cash flow ($)**	**Avoided Electricity Purchase at @ 25c/kWh ($)**	**15 year PPA @ 23c/kWh ($)**	**Net PPA Position ($)**	**PPA - Cumulative cash flow ($)**
0	0	0	0	0	0	0	0	0	0	0
1	-16423	-6953	-6953	-12664	-3194	-3194	6006	-5526	480	480
2	-16423	-6863	-13816	-12664	-3103	-6297	6111	-5526	586	1066
3	-16423	-6770	-20586	-12664	-3011	-9308	6219	-5526	693	1760
4	-16423	-6677	-27263	-12664	-2918	-12226	6328	-5526	802	2562
5	-16423	-6582	-33845	-12664	-2822	-15048	6439	-5526	913	3475
6		9938	-23906	-12664	-2726	-17774	6552	-5526	1026	4501
7		10037	-13870	-12664	-2627	-20401	6667	-5526	1141	5643
8		10137	-3733	-3413	6724	-13677	6784	-5526	1258	6901
9		10238	**6505**		10238	-3439	6903	-5526	1377	8278
10		10341	16846		10341	**6902**	7024	-5526	1499	9777
11		10446	27292		10446	17348	7147	-5526	1622	11399
12		10553	37845		10553	27901	7273	-5526	1747	13146
13		6161	44006		6161	34062	7400	-5526	1875	15021
14		10771	54777		10771	44833	7530	-5526	2005	17026
15		10883	65660		10883	55716	7662	-5526	2137	19163
16		10996	76656		10996	66712	6496		6496	25659
17		11112	87768		11112	77824	11112		11112	36771
18		11229	98997		11229	89053	11229		11229	48000
19		11348	110346		11348	100402	11348		11348	59349
20		11470	121815		11470	111871	11470		11470	70818
21		11593	133408		11593	123464	11593		11593	82411
22		11718	145126		11718	135182	11718		11718	94129
23		11845	156971		11845	147027	11845		11845	105974
24		11974	168945		11974	159001	11974		11974	117948
25		12105	181051		12105	171107	12105		12105	130054
	-82117	181051		-92061	171107		212936	-82883	13054	
	Loan NPV	$47,963		**Rental NPV**	$45,255		**PPA NPV**	$35,496		
	Loan IRR	20%		**Rental IRR**	22%		**PPA IRR**	n/a		