Solar (photovoltaics) and batteries

Solar photovoltaic (PV) systems harness direct sunlight converting this into electricity. Electricity produced by photovoltaic systems must be consumed at the time of production. However, meat processing facilities typically use most of their electricity during the middle of the day and it is becoming more attractive to couple photovoltaic systems with energy storage solutions such as batteries. This has the potential to maximise return on capital and harness more of the electricity produced.

In this worksheet we will examine the unique benefits of photovoltaic systems to the meat processing sector. We outline where synergies exist between the sector and the technology. We also take a look at batteries and in what circumstances you might consider deploying batteries.

How the technology works:

Types:

Roof-mounted solar PV systems are lower cost because the mounting infrastructure (your roof) has already been pre-installed. In most cases a roof inspection should be carried out to ensure that the roof has been engineered with enough capacity to hold the photovoltaic system. Roof inspections typically cost under $1,000.

Ground-mounted solar PV systems costs slightly more, but if you have the land area, enable you to install much more solar and benefit from economies of scale. Ground-mounted systems are installed with specialised solar PV mounting frames.

Tracking ground-mounted solar PV systems track the position of the sun on either 1-axis or 2-axis are becoming more common. Tracking systems produce more electricity per installed unit, but cost more to install. At feasibility stage a solar engineer will conduct screening analysis to determine whether a tracking system is viable.

Batteries can be installed on-site to enable storage of excess daytime solar production. This enables the electricity to be used on-site during the evening.

Value proposition:

- Low-cost electricity supply behind the meter.
- Projects are simple and reliable.
- Installer market is mature and installers understand the technology.
- Mitigate against carbon price risks.

- Financially benefit from government schemes associated with the Australian Renewable Energy Target (RET).
- Good match between solar PV production window and meat processing plant peak consumption.
- Small and large sites are all viable for solar.
- Reduce energy costs.

Life expectancy:

The solar PV panels will last for 20+ years and customers should select reliable PV module manufacturers that back their product up with a substantial warranty. Verify all component warranties to ensure these meet your specific requirements.

Solar inverters have a 10+ year lifespan. Inverters can be easily replaced as and when needed during the life of the solar PV system.

Modern batteries have a 10+ year lifespan with degradation to 70% of original capacity over 10 years.

Maintenance:

One major benefit of solar PV is that there are no moving parts. This is a somewhat overlooked benefit of solar PV – reliability is extremely high and owner's risks minimal.

It is recommended that monitoring of the solar PV system is always installed. If the system is producing less than it was when installed, module damage, inverter malfunction or dust may be impeding production.

Battery maintenance in modern battery systems is minimal. Major battery manufacturers typically use 'sealed' battery technologies which ensure that no fluids evaporate from the battery. Manufacturers may have some specific maintenance requirements, but generally only monitoring is needed to detect faults.

Skills required to own and operate:

With 1.8+million solar PV systems installed across homes and businesses in Australia, it is fair to say that no special skills are required to own and operate a solar PV system.

Best practice would see you monitoring and managing your solar PV system as you would any other key production asset.

What is needed for the technology to be attractive at a red meat facility:

Typical IRR of a solar project is in the range of 12% to 30% depending on your underlying electricity cost. Comparing this to other investment opportunities available to meat processors, solar represents a reasonable and low risk opportunity.

The addition of batteries to solar PV systems is harder to justify at the time of writing. Batteries enable the owner to 'buy low sell high' or 'buy low and use electricity when price is high'. Electricity is stored from either solar production or simply grid-purchased during off-peak periods and then used during periods when electricity prices are high (colloquially referred to as price arbitrage). Economic value is

derived through the differential between the buy price (or value of produced solar) and the avoided electricity purchase cost.

Simple worked example for a 100 kWh battery:

Table 1 - battery price arbitrage simple analysis

Project element	*Value*	*Unit*
Battery unit cost	400	$/kWh
Battery size	100	kWh
Battery cost	$ 40,000	
Battery efficiency	90%	
Peak electricity price	20	c/kWh
Off-peak/solar electricity price	10	c/kWh
Saved per day	$ 9	/day
Saved per year	$ 3,285	
Payback	12.2	years

The highlighted rows in Table 1 are changing dramatically with battery costs coming down by more than 73% (2010-2016[i]) and recently in Australia, the price of electricity has been increasing. Watch this space as batteries become viable in more and more situations across Australia in the coming years.

A more complex use case for batteries is to target a reduction in your peak network costs. Your electricity provider reports network costs on your bill as a $/kVA or $/kW basis. The aim of these projects is to reduce your peak network demand by discharging your battery at the time that your peak network demand is occurring. Control regimes vary on a customer by customer basis.

Solar options analysis

It is essential to complete a detailed economic assessment based on technical limitations of the project or site and the available solar PV options. The assessment should incorporate as a minimum:

- Site consumption data on an hourly basis
- Customer's tariff details
- Solar resource data at the site's location
- Various system sizes
- Hourly export and local consumption profiles on hourly basis
- Consider forward electricity prices and carbon price risks
- Roof-mounted versus ground-mounted where applicable
- Incentives and/or rebates associated with government regulation.

Systems below 100 kW receive greater financial benefits through the Australian Renewable Energy Target. The detailed assessment should consider systems below and above 100 kW to assess this impact. An example assessment can be viewed here: sample assessment

Lead time

The lead time from date of purchase to final commissioning can be as little as 1-6 months for roof-mounted to 3-12 months for ground mounted systems.

Battery demand has been high, and manufacturers are experiencing challenges keeping up with demand. The lead time for batteries will therefore depend on market circumstances at the time of purchase.

Pre-feasibility study requirement

We would suggest that a full pre-feasibility study is not needed.

A solar options analysis should be completed to ensure that the customer is getting a system that is optimally sized and configured for their site.

For roof-mounted systems, a roof engineering assessment is recommended to ensure the roof can withstand the weight added by the solar PV system.

Connection approvals can be sought in advance of procurement. Each electricity distribution business has its own process for connection approval of a solar PV system to their grid. It is common for the solar PV system designer to complete the connection approvals.

Legislative and regulatory factors:

In order to be eligible for some financial benefits associated government regulation, the system must be installed by a Clean Energy Council (CEC) approved installer (https://www.solaraccreditation.com.au/). It is now standard industry practice for installers to be accredited with CEC. By selecting a reputable installer, you are not likely to discover any non-certified installers.

Small-scale Technology Certificates (STCs) are granted to eligible small-scale renewable energy systems under 100 kW. To the customer, STCs are typically presented as a reduction in the upfront cost of the system.

Large-scale Generation Certificates (LGCs) can be created per megawatt hour (MWh) of eligible electricity generated by a solar PV power station greater than 100 kW. Once created, LGCs can be transferred or sold to entities with liabilities under the Australian Government's Renewable Energy Target.

Both STCs and LGCs are taken into consideration during the economic assessment phase of a solar PV project.

Buyer check list:

- Site scoping analysis (roof or ground-mounted system)
- Site consumption data on hourly basis
- Site tariff details

- Solar options analysis
- Economic assessment considering a range of systems
- Roof engineering assessment
- Accredited installer and accredited components
- Connection approvals

This fact sheet has been prepared by Beam Energy Labs Pty Ltd in association with Smart Business Hub in 2018.

[i] Lithium-Ion Battery Costs and Market, Claire Curry Bloomberg New Energy Finance July 2017, https://data.bloomberglp.com/bnef/sites/14/2017/07/BNEF-Lithium-ion-battery-costs-and-market.pdf